Manitoba
Energy and Mines
Mines Branch

Open File Report OF89-5

Platinum-Group Metals in Manitoba - An Inventory

By P. Athayde
Winnipeg, 1989

Energy and Mines

Hon. Harold J. Neufeld
Minister

Ian Haugh
Deputy Minister

Minerals Division

Sobharam Singh
Assistant Deputy Minister

Mines Branch
W.A. Bardswich
Director

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INTRODUCTION

Manitoba's total output of platinum-group metals (PGM) from 1983 to 1986, derived as by-products from nickel ores, is estimated at 3374 kg or $34.1 million (Table 1). Total 1987 by-product PGM production was valued at $17.78 million. Manitoba's share of Canada's reported PGM production has ranged from 5.9% in 1971 to 13.8% in 1983.

TABLE 1
Manitoba Platinum-group Metal Production and Value
1983 - 1987

YEAR	QUANTITY (000g)	VALUE ($000)
1983	965	8 880
1984	862	8 473
1985	666	6 885
1986*	881	9 873
1987	---	17 780

* estimated

Source: Manitoba Energy and Mines,
Annual Reports 1983/84 - 1987/88

Nickel-copper mines that are reported to have produced some PGM as by-products include: the Lynn Lake mines operated by Sherritt Gordon Mines, Limited between 1953 and 1976; the Thompson mines operated by Inco Limited since 1960; the Dumbarton Mine operated jointly by Consolidated Canadian Faraday Limited and Maskwa Nickel Chrome Mines Limited (59% owned by Falconbridge Nickel Mines Limited) through Dumbarton Mines Limited from 1969 to 1973; and the Manibridge Mine operated by Falconbridge Nickel Mines Limited from 1971 to 1977. PGM are also contained in nickel ores of the Namew Lake Mine, which began operation in late 1988 under the joint ownership of Hudson Bay Mining and Smelting Co., Limited and Outokumpu Mines Limited.

This report describes the sixty-one known PGM occurrences in Manitoba (Fig. 1, 2, 3, 4; Table 2) with PGM values that range from trace in sample assays to small amounts contained as by-products in nickel-copper deposits. Also included in this report are brief descriptions of current PGM exploration projects, and other potential PGM exploration targets. For completeness any reference to PGM has been included in the Selected Bibliography, regardless of how vague the reference might be.

Descriptions of several properties were obtained from associated gold, chromite, nickel or copper Mineral Inventory cards published by Bamburak (1980). Microfiche copies of all Mineral Inventory cards referenced in this report, are included in Appendix A. Detailed histories of exploration and development work carried out on these properties are also documented in the cards.

Information sources for this report include: Non-confidential (or cancelled) assessment files, corporation files (including old newspaper clippings), unpublished information files, mining engineering files, and mineral inventory cards, all of which are on file at the Mines Branch, Manitoba Energy and Mines; various publications of Manitoba Energy and Mines, the Geological Survey of Canada (GSC) and the Northern Miner; and personal communication with P. Theyer. Several platinum references were extracted from the computerized Bibliography to Manitoba Geology compiled by L.E. Chackowsky, and from the computerized Claims Assessment file by D. Boychuk.

Previous Work

Previous overviews of PGM occurrences in Manitoba are found in reports by O'Neill and Gunning (1934, p. 74) and Mertie (1969, pp. 26, 27). An overview of environments favorable for PGM in Manitoba was presented by P. Theyer at the Manitoba Energy and Mines, Geological Services Branch, 1987 Annual Meeting with Industry, Winnipeg, Manitoba.

Acknowledgements

This compilation was initiated by W.D. Fogwill and J.D. Bamburak (Exploration Services, Manitoba Mines Branch) under the 1984-1989 MDA Agreement, in response to the growing interest in PGM exploration in Manitoba.

The author gratefully acknowledges the supervision and guidance received from J.D. Bamburak who also critically read several drafts of this report. D.A. Baldwin is thanked for critically reading the manuscript and offering many helpful and constructive comments. P. Theyer kindly provided several of the platinum references during the initial compilation stage. W.D. Fogwill, W.D. McRitchie, and P. Theyer reviewed a previous version of the manuscript, and provided helpful editorial comments. Editing of the manuscript was done by J.D. Bamburak and D.A. Baldwin.

Some of the maps and figures accompanying this report were drafted by Lidia Ghobrial and Manuel Carvalho. The manuscript was typed by Heather Wilkie, Darlene Littlejohn, and Shirley Weselak.

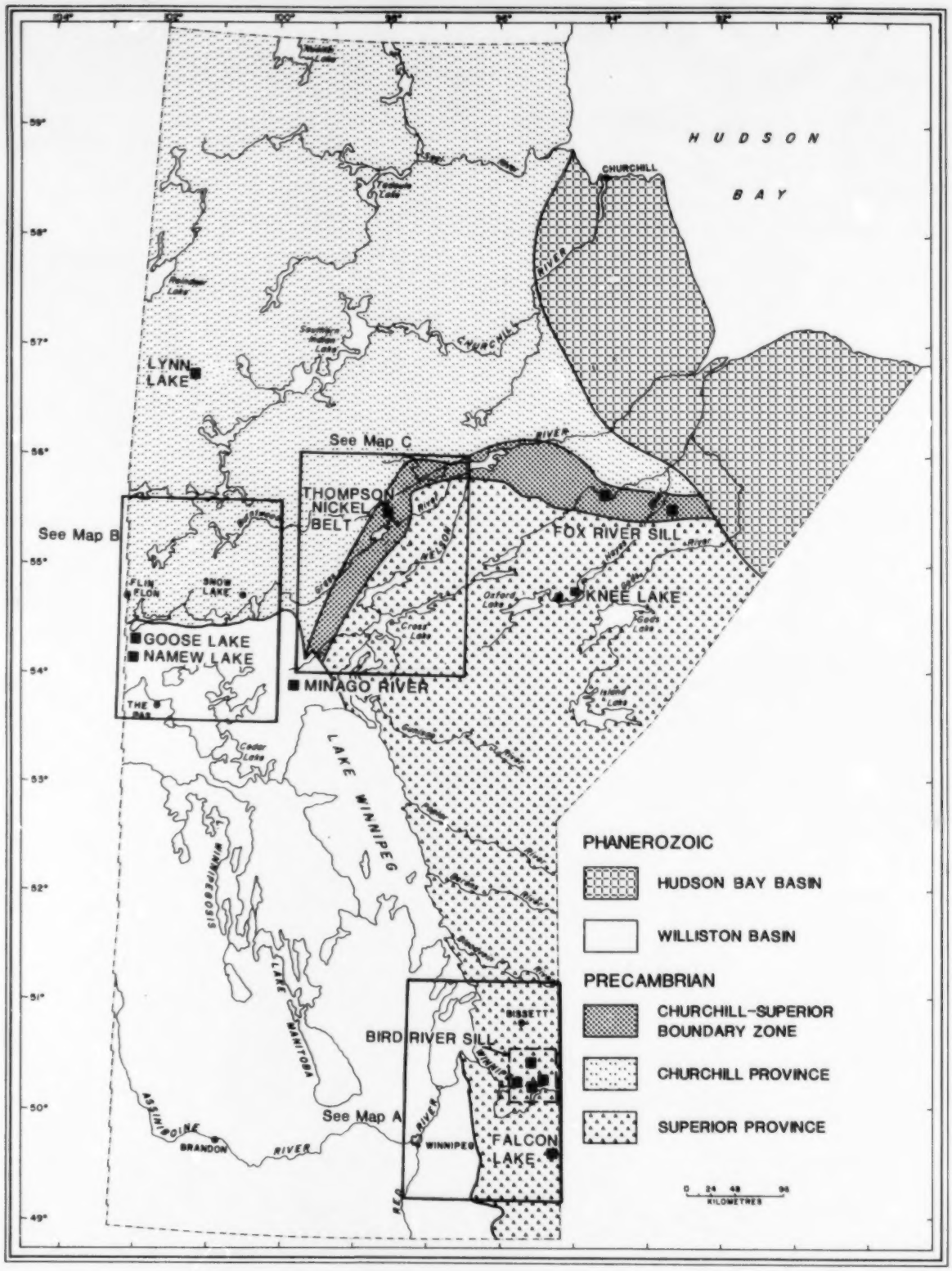

Figure 1: Major geological subdivisions of Manitoba, major and minor PGM occurrences, and outlines of detailed location maps A, B and C.

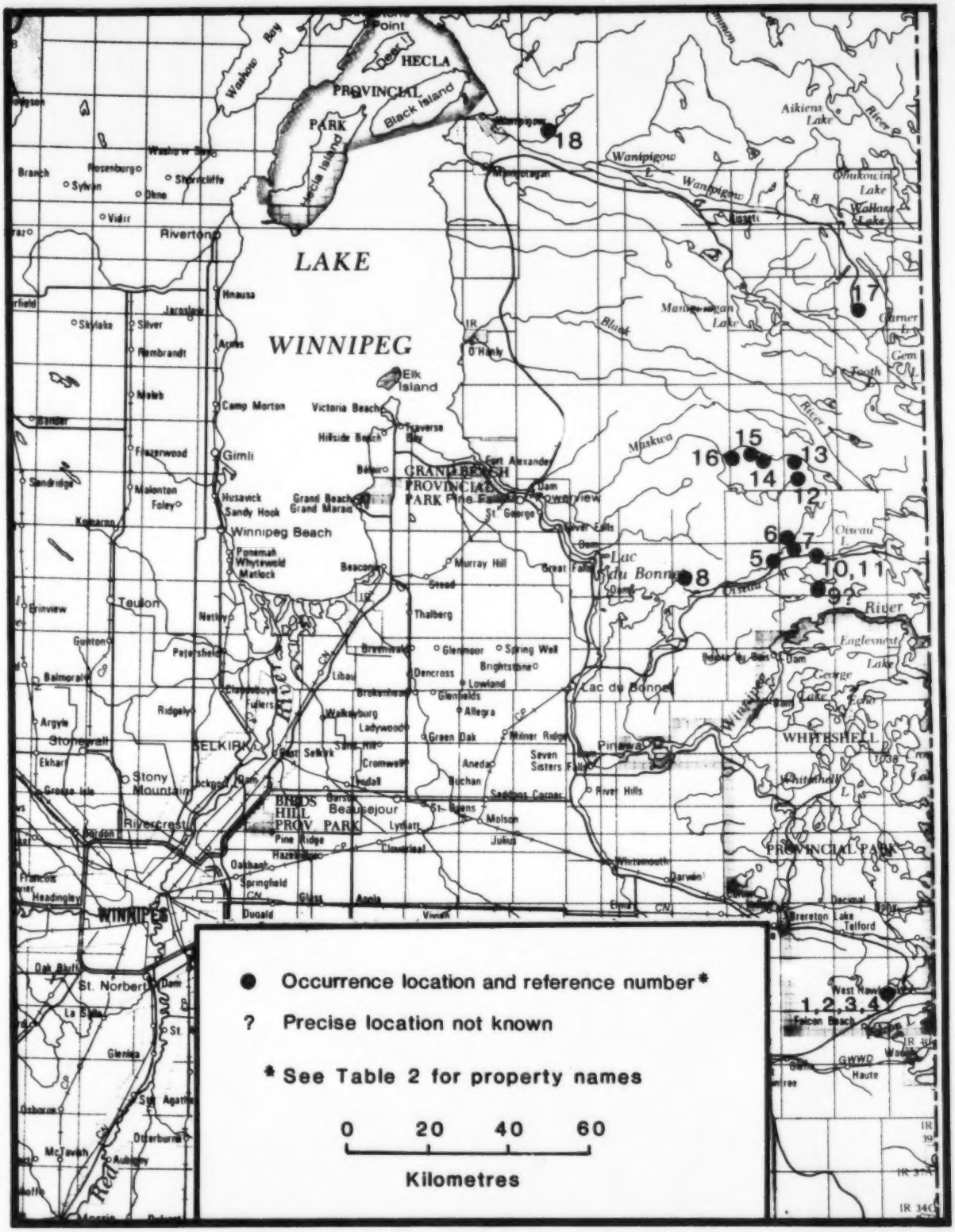

Figure 2: Regional Location Map A: PGM occurrences in part of the Superior Province.

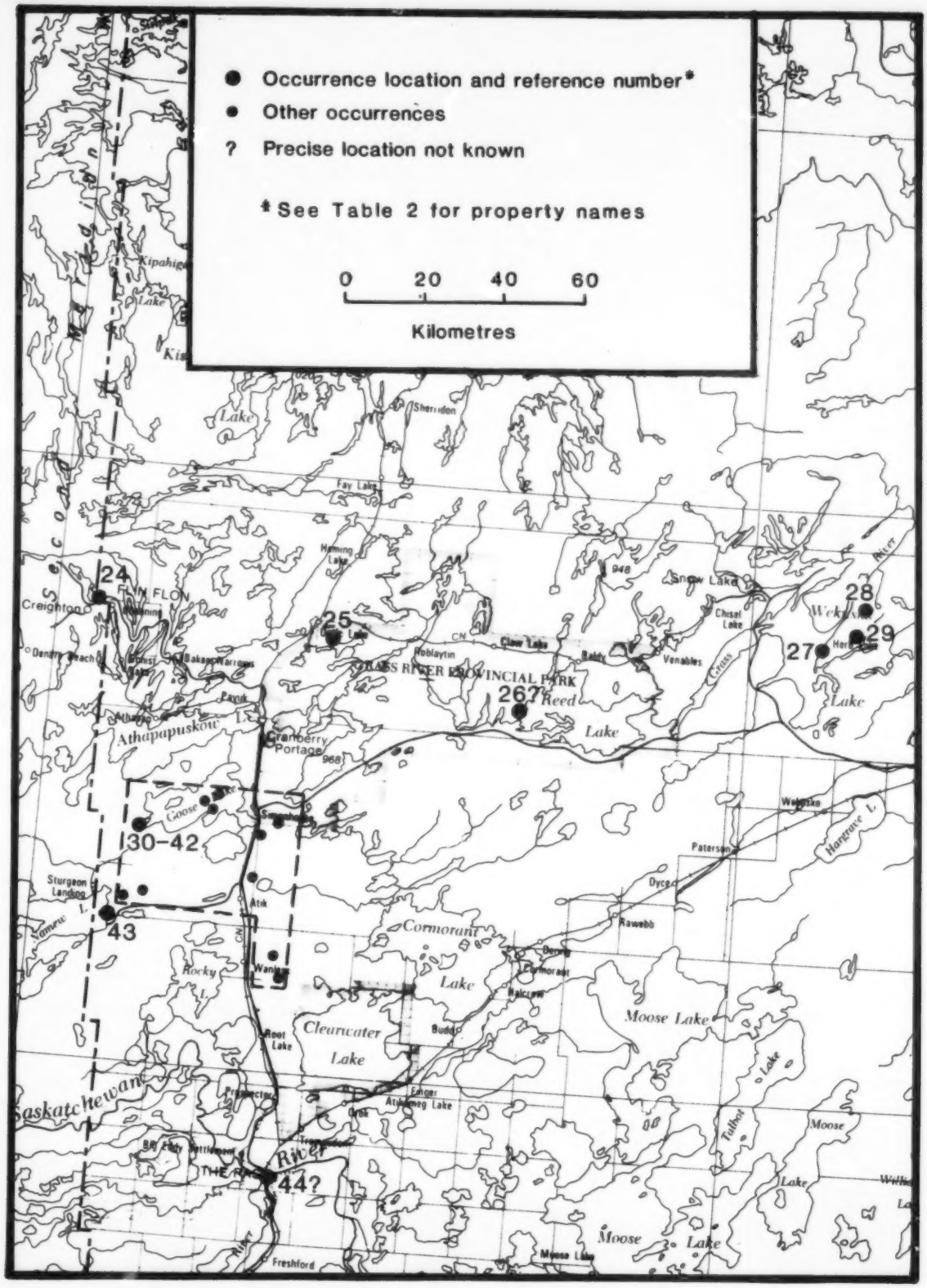

Figure 3: Regional Location Map B: PGM occurrences in part of the Churchill Province.

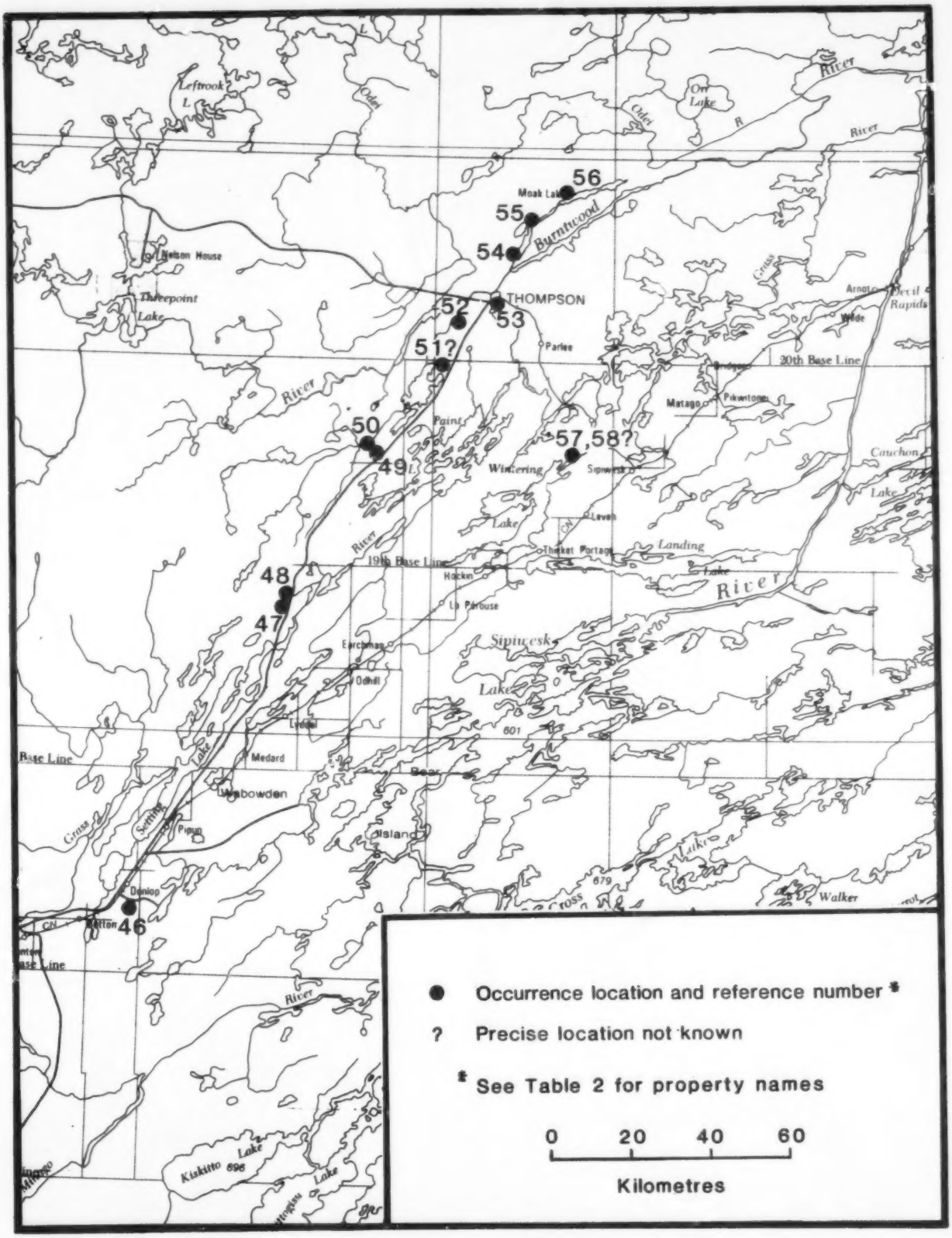

Figure 4: Regional Location Map C: PGM occurrences in part of the Churchill - Superior boundary zone.

TABLE 2
Index to Platinum-group Metal Occurrences in Manitoba

OCCURRENCE	NTS	PROPERTY	PLATINUM-GROUP METALS (maximum values)	ASSOCIATED MINERAL INVENTORY CARD	MAP
SUPERIOR PROVINCE					
WEST HAWK-FALCON LAKE AREA					
1	52E/11NE	Gold Coin	3.429 g/tonne Pt	52E/11 AU11, PT1	A
2	52E/11NW	Moore (Penniac Reef)	0.0045 g Pt, 0.0005 g Ir, Os reported	52E/11 AU4, PT1	A
3	52E/11NW	Waverley	Trace Pt	52E/11 AU3, PT1	A
4	52E/11NW	Sunbeam	Trace Pt	52E/11 AU2, PT1	A
BIRD RIVER GREENSTONE BELT					
5	52L/5NE	Chrome	1.6 ppm Pt; PGM's reported	52L/5 CR1, PT1	A
6	52L/5NE	Page	Trace Pt; Pt and Pd reported	52L/5 CR2, PT1	A
7	52L/5NE	Ore Fault (Lucky Boy)	Pt reported	52L/5 NI1, PT1	A
8	52L/5NW	Trimpus	1.37 g/tonne Pt, 1.71 g/tonne Pd; 540 ppb Pt, 780 ppb Pd	52L/5 CR3, PT2	A
9?	52L/5,6	Winnipeg River area (Shatford, Bernic and Birse Lakes)	Pt reported		A
10	52L/6NW	Dumbarton Mine	1.234 g/tonne Pt, 4.114 g/tonne Pd; 260 ppb Pt, 1760 ppb Pd; 78.13 kg PGM produced 1970 - 1973	52L/6 NI1, PT1	A
11	52L/6NW	Maskwa West Pit	Pt and Pd	52L/6 NI2, PT1	A
12	52L/11SW	New Manitoba	Minor traces Pt/Pd	52L/11 CU1; 52L/12 PT1	A
13?	52L/11SW, 11NW, 12SE	Wellington claims; Bird claims	Pt reported	52L/11 CU1, CU2; 52L/12 PT1	A
14	52L/12NE	Hititrite M.C.	0.02% Pt, 0.01% Pt; 520 ppb Pt, 710 ppb Pd	52L/12 CU2, PT1	A
15	52L/12NE	Mayville	210 ppb Pt, 570 ppb Pd	52L/12 CU2, PT1	A
16	52L/12NE	Nova	0.03% Pt	52L/12 PT1	A
RICE LAKE GREENSTONE BELT					
17	52L/14SW	Mirage Property	20 ppb Pt, 300 ppb Pd	52L/14 AU3	A
18	62P/1NE	English Lake	Trace palladium		A
KNEE LAKE - GODS LAKE GREENSTONE BELT					
19	53L/15NW	Knee Lake (Kul No. 2)	0 034 g/tonne Pt 0.034 g/tonne Pd		Fig. 1
20	53L/14SE	Knee Lake (See 15)	0.034 g/tonne Pd		Fig. 1

TABLE 2 (Cont'd)

OCCURRENCE	NTS	PROPERTY	PLATINUM-GROUP METALS (maximum values)	ASSOCIATED MINERAL INVENTORY CARD	MAP
OTHER OCCURRENCES					
21?*	53E	Island Lake area	"Copper-nickel showings with associated platinum values along a band of ultramafic rocks are also being evaluated"		Fig. 5: No. 7
CHURCHILL PROVINCE					
22*	64C/14SE	Lynn Lake: A and/or EL mines (?)	1.36 g/tonne Pd, 0.18 g/tonne Pt, 0.018 g/tonne Rh; PGM's produced	64C/14 NI1, NI2, PT1	Fig.10: Nos. 1,2
23*	64C/15NE	Tulune Lake	0.09 g/tonne Pt, 0.31 g/tonne Pd	64C/15 CU4	Fig.10: No. 7
FLIN FLON-SNOW LAKE GREENSTONE BELT					
24	63K/13SW	Flin Flon Mine	0.056 g/tonne Pd, 0.07 g/tonne Rh	63K/13 CU3	B
25?	63K/11NE	Copper and Brunne Lakes (Caribou claim?)	Pt reported		B
26?	63K/9,10	Reed Lake	Pt reported		B
27	63J/13SW	MooseHorn	Pt reported	63J/13 AU4	B
28	63J/13SE	McCafferty's Prospect	$17 (13 g/tonne) in platinum; 30 ppb Pt	63J/13 AU13	B
29	63J/13SE	Ferro Mine	80 ppb Pt; 140 ppb Pd	63J/13 AU2	B
PHANEROZOIC-COVERED AREAS					
30-42	63K/3,5,6	Goose Lake area	1.611 g/tonne Pt; traces Pt/Pd (12 other indications)	63K/5 PT1	B
43	63K/4NW	Namew Lake Mine	0.479 g/tonne Pd, 0.651 g/tonne Pt	63K/4 NI1	B
44?	63F/14	The Pas	Pt reported		B
CHURCHILL-SUPERIOR BOUNDARY ZONE					
FOX RIVER GREENSTONE BELT					
45?*	53N/10-15 53M/16	Fox River Sill	0.27 g/tonne Pt and Pd; 1200 ppb PGM's	53N/11 PT1	Fig.13: Nos. 1,2
THOMPSON NICKEL BELT					
46	63J/10NW	Manibridge Mine	170 ppb Rh, 994 ppb Pd, 300 ppb Pt; 59.09 kg PGM produced 1971-1972	63J/10 NI1; 63P/12 PT1	C
47	63O/1NW	Soab South Mine	Pt/Pd ratio: 0.87	63O/1 NI1; 63P/12 PT1	C

TABLE 2 (Cont'd)

OCCURRENCE	NTS	PROPERTY	PLATINUM-GROUP METALS (maximum values)	ASSOCIATED MINERAL INVENTORY CARD	MAP
48	63O/1NW	Soab North Mine	Pt/Pd ratio: 0.86; 2880 ppb Pd, 1820 ppb Pt	63O/1 NI2; 63P/12 PT1	C
49	63O/8NE	Pipe No. 1 Mine	Pt/Pd ratio: 0.48	63O/8 NI3; 63P/12 PT1	C
50	63O/8NE	Pipe No. 2 Mine	Pt/Pd ratio: 1.46; PGM's reported	63O/8 NI3; 63P/12 PT1	C
51?	63P/12SW	South Manasan	Pt/Pd ratio: 0.45	63P/12 PT1	C
52	63P/12NW	Birchtree Mine	Pt/Pd ratio: 0.81	63P/12 NI1, PT1	C
53	63P/12NW	Thompson Mine	Pt/Pd ratio: 0.49; 2441.6 kg PGM produced 1970-1972	63P/12 NI2, PT1	C
54	63P/13SW	Mystery Lake South	Pt/Pd ratio: 1.27	63P/13 NI2; 63P/12 PT1	C
55	63P/13NE	Mystery Lake North	Pt/Pd ratio: 0.28	63P/13 NI3; 63P/12 PT1	C
56	63P/13NE	Moak Lake	Pt/Pd ratio: 0.89; 245 ppb Pd, 25 ppb Pt	63P/13 NI1; 63P/12 PT1	C
OTHER OCCURRENCES					
57	63P/5NE	Wintering Lake: Homebrew claim	Pt reported	63P/5 CU1	C
58?	63P/5	Wintering Lake: Rat claim	Pt reported	63P/5 CU1	C
PHANEROZOIC-COVERED AREAS					
59*	63G/5NE	Cedar Lake	Minor (26 ppb Ru, 24 ppb Pt, 16 ppb Pd, l2 ppb Rh, 9 ppb Ir, 7 ppb Os)		Fig. 5: No. 8
60*	63J/6SE	Hargrave River	Minor (132 ppb Pd, 12 ppb Pt, 10 ppb Ru, less than l00 ppb Ir)	63J/6 CR1	Fig. 5: No. 9
61	63J/3SE	Minago River	Pt/Pd reported	63J/3 NI1	Fig. 1

? Location not known with certainty.
* These occurrences are located on figures, with location numbers as shown in the map column.
Abbreviations: Pt - Platinum; Pd - Palladium; Ru - Ruthenium; Rh - Rhodium; Os - Osmium; Ir - Iridium.

HISTORY OF PLATINUM-GROUP METAL EXPLORATION IN MANITOBA 1915-1988

The history of platinum-group metal (PGM) exploration in Manitoba is associated with that of gold, nickel, copper and chromite. Exploration and development of these metals resulted in the discovery of some associated PGM mineralization.

1) Pre-1920

The first known reported occurrence of PGM was in the Falcon Lake area in 1915, when A.G. French detected minor concentrations of platinum and iridium in assays of the second gold bar produced from the Penniac Reef Gold Mine (Manitoba Mines Branch, Corporation File, Star Lake Gold Mines, Limited). Osmium was also reported to occur in one of the drifts in the mine (Manitoba Mines Branch, Mining Engineering File, Star Lake Mines Limited). Samples of gold-quartz veins in the same locality returned traces of platinum in assays (Marshall, 1918). One sample from the Gold Coin claim assayed 3.429 g/tonne Pt. However, a sampling program carried out over ten claims (Magpie, Jewel, Georgius, Enterprise, Hall, Boyes, Penniac Reef, Gold Coin, Waverley, and Sunbeam) in the area in 1918 gave nil results in PGM (Bruce, 1919).

In the Wekusko Lake area (northern Manitoba), platinum was reported to occur in gold-bearing quartz veins of the Moose Horn/Ballast prospect and the McCafferty prospect (Canadian Mining Journal, 1916). Other gold-bearing properties in the area such as the Rex and the Elizabeth mines were also examined for PGM at the time.

2) 1920-1930

In 1920, during exploration for copper and nickel in the north limb area of the Bird River Sill (BRS), platinum was detected in assays of samples collected from the Hititrite and Nova claims (McCann, 1921). By 1928, platinum was known to occur in the Maskwa (Bear) and Oiseau (Bird) River areas, located on the north and south limbs of the BRS, respectively (Manitoba Mines and Natural Resources, 1928). In 1929, a Ni-Cu mineralized zone on the Wellington and Bird claims, located near the north limb of the BRS, was reported to contain platinum by The Bear River Copper Company Limited and Backus-Mcleod Exploration Company Limited (Manitoba Mines Branch, Corporation Files).

In northern Manitoba, occurrences of platinum were noted in the Copper-Brunne Lake areas in 1920, and in the Wintering Lake district in 1928-1929, and northeast of Elbow Lake in 1929 (Wallace, 1920, p. 31; Manitoba Mines Branch, Unpublished Information File, 63P/5NE, Mining Engineering File, Great Northern Lakes Drilling, Mining and Development Syndicate). Wallace (1928, p. 45) noted that traces of platinum had been found in "pyrrhotite bodies" in northern Manitoba.

3) 1931-1979

Several isolated occurrences of PGM were reported from the south limb area of the Bird River Sill between 1936 and 1975. In 1936-1937, several claims in the Dumbarton Mine area were drilled by Stanmore Mining and Smelting Limited. It was concluded that "traces of platinum group, gold and silver were found in most of the Oiseau cores" (Browne, 1938). In the early 1940's, platinum was noted in chromite from the Page claim area of the BRS, by Hudson Bay Mining and Smelting Co., Limited (Bateman, 1943). A limited sampling program carried out in the West Hawk Lake - Falcon Lake area in 1950 by Springer (1952), gave nil results in PGM.

It was later reported that 1968 drill core from the Dumbarton Ni-Cu deposit contained platinum and palladium (Manitoba Mines Branch, Mineral Inventory card 52L/6 NI 1). Results of flotation-concentrate assays indicated contents of up to 4.114 g/tonne Pd and up to 1.234 g/tonne Pt (Karup-Møller and Brummer, 1971). A total of 68.43 kg of PGM by-products were recovered from the ore during the period 1970 to 1972 (Report of the Task Force, 1974). The deposit yielded 9.70 kg of palladium in 1973 (Consolidated Canadian Faraday Limited, Annual Report, 1973). The Dumbarton deposit was mined by Dumbarton Mines Limited.

Platinum was also reported in a Ni-Cu prospect (Lucky Boy claim area, BRS) that had been drilled and bulk-sampled by Bird River Mines Co. Ltd. (Northern Miner, January 14, 1971). In 1973, Canex Placer Limited reported four Pt-Pd-bearing zones with assays of up to 1.37 g/tonne Pt and 1.71 g/tonne Pd over a 12.2 m section of drill core from the Trimpus claim located near the south limb of the BRS (Manitoba Mines Branch, Non-confidential Assessment File No. 91382). In 1975, CANMET reported that base metal deposits with minor platinum and palladium occur 1.6 km north of the junction of the Cat Lake and Bird Lake roads (Raicevic, 1975, p. 7).

In northern Manitoba, platinum was noted in 1947 during early exploratory drilling of the Lynn Lake nickel deposits by Sherritt Gordon Mines, Limited (Manitoba Mines Branch, Unpublished Information File, 64C/14). In 1953, spectrographic analyses of nickel ores from Lynn Lake indicated platinum, palladium, and rhodium (Hawley and Rimsaite, 1953). Following the development of these deposits and improvements in the milling process, a small amount of PGM was produced (Mertie, 1969, pp. 18, 27). In 1953, small amounts of rhodium and palladium were found in copper ores from Flin Flon (Hawley and Rimsaite, 1953).

In 1956, the Thompson nickel orebody was reported to contain Pt and Pd (Northern Miner, December 6, 1956; Quinn, 1957). Quinn (1956) noted the platinum potential of the Thompson Nickel Belt (TNB) area. At least ten nickel deposits (Moak Lake, Mystery Lake North, Mystery Lake South, Soab South Mine, Soab North Mine, Pipe 1 Mine, Pipe 2 Mine, Thompson, Birchtree, and Manibridge) in the TNB have been reported to contain platinum-group metals (see Mertie, 1969; Manitoba Mines Branch, Mineral Inventory card 63P/12 NI 1; Hogan, 1974; Report of the Task Force, 1974; Naldrett and Cabri, 1976; Bamburak, 1977, p. 15; Fraser, 1985, pp. 37, 65). In 1960, traces of Pt and Pd were detected in drill core from the Knee Lake area by Canadian Nickel Company Limited. Platinum-group metals were reported in a 2.13 m section of drill core from the Tulune Lake area (located 25.4 km northeast of Lynn Lake)

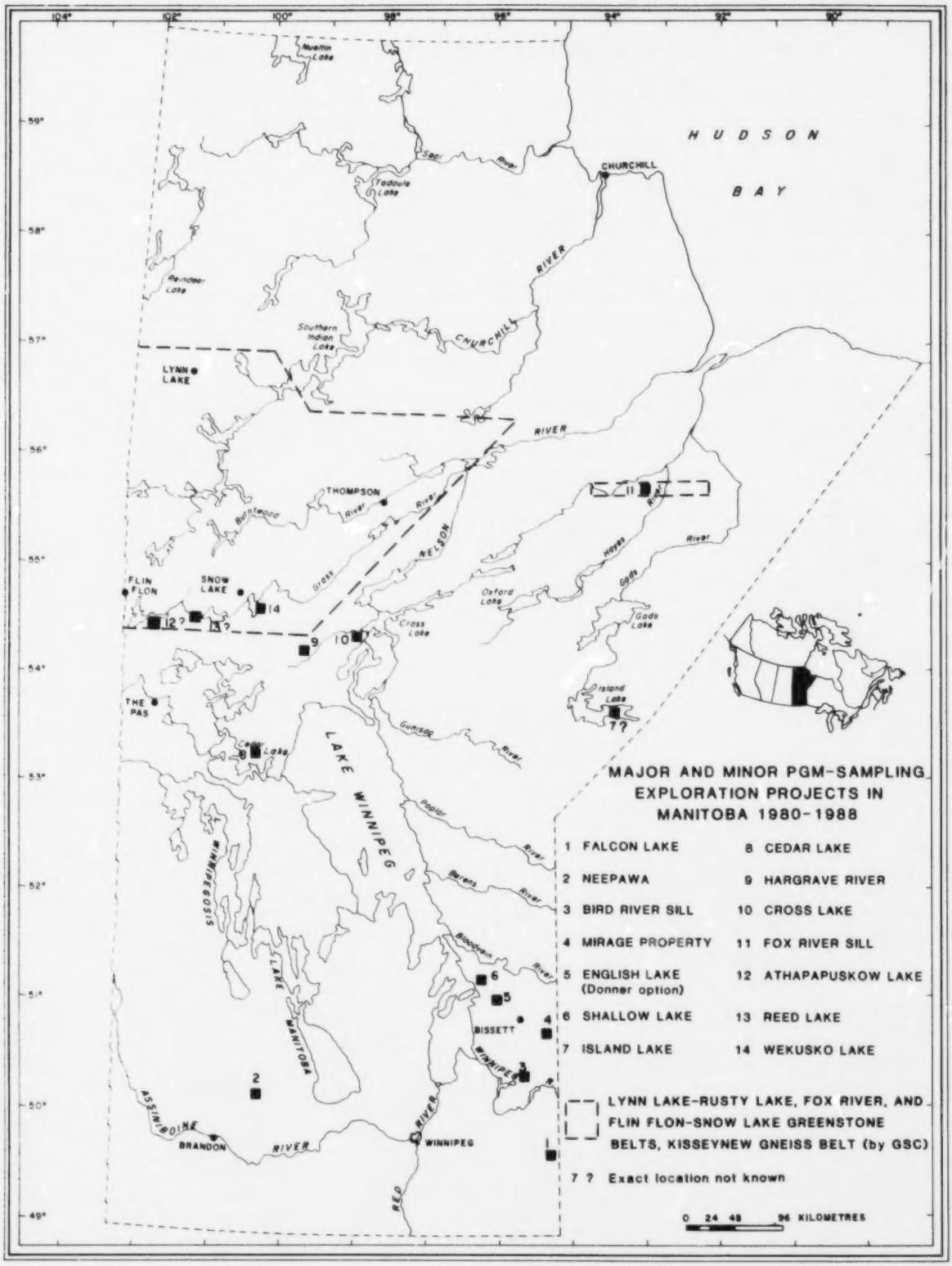

Figure 5: PGM-sampling exploration projects in Manitoba: 1980-1988.

in 1969 (Manitoba Mines Branch, Non-confidential Assessment File No. 91031).

From 1970 to 1972, 2442 kg of PGM were produced from the Thompson mines by Inco Limited indicating an annual production of 814 kg of PGM as by-products of the nickel-refining process (Manitoba Mines Branch, Mineral Inventory card 63P/12 NI 2; Report of the Task Force, 1974).

Falconbridge Nickel Mines Limited (owner of the Manibridge deposit) had a total by-product PGM production from Manitoba of 59.09 kg for the period 1971 - 1972 (Report of the Task Force, 1974). Grice (1976, pp. 113, 114) studied the PGM content of mineral samples obtained from the Thompson and Birchtree mines. Platinum-group element (PGE) studies of the Manibridge and Pipe deposits were reported by Naldrett and Cabri (1976) and Naldrett et al.(1979), respectively.

4) 1980-1988

Theyer (1981) initiated a platinum program in the Bird River Sill area sampling chromitite layers of the Mayville, Euclid Lake, Page, Chrome, and National-Ledin claim areas. This represented the first reported systematic search for platinum in Manitoba since the 1917-1918 sampling programs by Marshall (1918) and Bruce (1919) of the GSC in the Falcon Lake area.

Since 1982, extensive research of the chromite and PGM deposits of the BRS, has been carried out by the Geological Survey of Canada and the Manitoba Energy and Mines, Geological Services Branch. One sample from the Chrome claim yielded 1.6 ppm platinum (Theyer, 1982). PGM and PGM alloy inclusions in chromite from the Chrome claim were noted in 1982 during microprobe studies (Talkington et al., 1983). Detailed PGE studies were also carried out by Theyer (1985a) and Ohnenstetter et al.(1986). Results of PGE studies of the BRS carried out by the GSC were presented at the Geo-Platinum '87 Symposium in Milton Keynes, U.K. in April 1987, and published by Hulbert et al.(1988). The GSC re-examined the Falcon Lake area for its platinum potential, but could not confirm the presence of PGM with gold (Scoates, 1987a).

In northern Manitoba, traces of platinum and palladium were reported from at least thirteen drill holes that were drilled in various parts of the Paleozoic-covered Goose Lake-Namew Lake area by Canadian Nickel Company Limited in 1980-1981 (Manitoba Mines Branch, Non-confidential Assessment File Nos. 92471, 92473). Results of microprobe analyses of PGM's from the Pipe deposit (in the Thompson Nickel Belt) were reported by Cabri and Laflamme (1981) of CANMET. Peredery et al.(1982, p. 180) also reported the Pt/Pd ratios of several nickel deposits in the TNB.

The Namew Lake nickel deposit, discovered in 1984 under Paleozoic-cover during follow-up work on airborne geophysical anomalies, is currently being mined jointly by Hudson Bay Mining and Smelting Co., Limited and Outokumpu Mines Limited. It has drill indicated reserves of 2.58 million tonnes grading 2.44% Ni, 0.9% Cu, 0.102 g/tonne Au, 4.11 g/tonne Ag, and 0.479 g/tonne Pd, 0.651 g/tonne Pt (Pickell, 1987).

Scoates and Eckstrand (1985) noted the PGM potential of the Fox River Sill area. The following year, PGM mineralization was reported in drill core samples from the west lobe of the Fox River Sill (Scoates and Eckstrand, 1986). Results of further studies of PGM in the sill were reported by Schwann and Scoates (1988). A joint venture agreement was signed between Silver Lake Resources Inc. (later renamed, International Platinum Corporation) and BP Canada Inc. to explore for PGM in Manitoba; BP could earn a 60% interest in Silver Lake's Manitoba platinum property by spending $1 million on exploration (Northern Miner, January 27, 1986). Drill core assay results of a five hole, 1524 m diamond drill program carried out by BP Resources Canada Limited - Selco Division in the Fox River Sill area, indicated the presence of several platinum-bearing zones (Northern Miner, April 21, July 7, 14, 1986). Platinum was also reported from the Island Lake area (Northern Miner, July 7, 1986). In 1987, platinum was reported from the Reed Lake area (International Platinum Corporation, Annual Report, 1986; Northern Miner, March 30, 1987).

The GSC carried out preliminary investigations of the PGM contents of nickel-copper ore samples in their collections. Samples from the Lynn Lake and Thompson Nickel Belt areas were analyzed (Jonasson et al., 1987). The GSC is currently examining selected intrusions in the Kisseynew gneiss belt and in the Lynn Lake-Rusty Lake greenstone belts (Tow Lake intrusion, Fraser Lake complex, Sickle Lake intrusion), and mafic-ultramafic intrusions in the Flin Flon-Snow Lake greenstone belt (including the Reed Lake complex), for PGM (Scoates, 1987b, 1988; Hulbert, 1987).

Contents of up to 63 ppb Pt, and 50 ppb Pd were obtained from the Sickle Lake intrusion (Hulbert, 1988). However, basaltic volcanic rocks from the Magrath, Barrington, Tod, Hughes, Miskwa, Corkeram and Hughes Lakes areas of the Lynn Lake greenstone belt, as well as from "Division B and D" of the northern belt, (analyzed for PGE by stable isotope dilution ICP-MS), were found to contain "very high levels" of Pt and Pd (Hulbert, 1988). The levels are anomalous for volcanic rocks on a world-scale.

In 1986-1988, several additional localities were examined for PGM by various private companies and by the Manitoba Government. These areas include: Cross Lake, Cedar Lake, Hargrave River, and Athapapuskow Lake in northern Manitoba; and Shallow Lake, English Lake, Stormy Lake, and Neepawa in southern Manitoba (Fig. 5). In a presentation of 'Platinum Environments in Manitoba' by P. Theyer at the Geological Services Branch, 1987 Annual Meeting with Industry, several new platinum exploration targets were suggested; these include: the Seal River and Manigotagan areas for platinum placers; southern portions of the TNB; and the Tartan Lake area.

Platinum exploration activity in Manitoba may increase following the Royal Canadian Mint's recent decision (Northern Miner, July 25, 1988) to produce 'platinum' Maple Leaf coins.

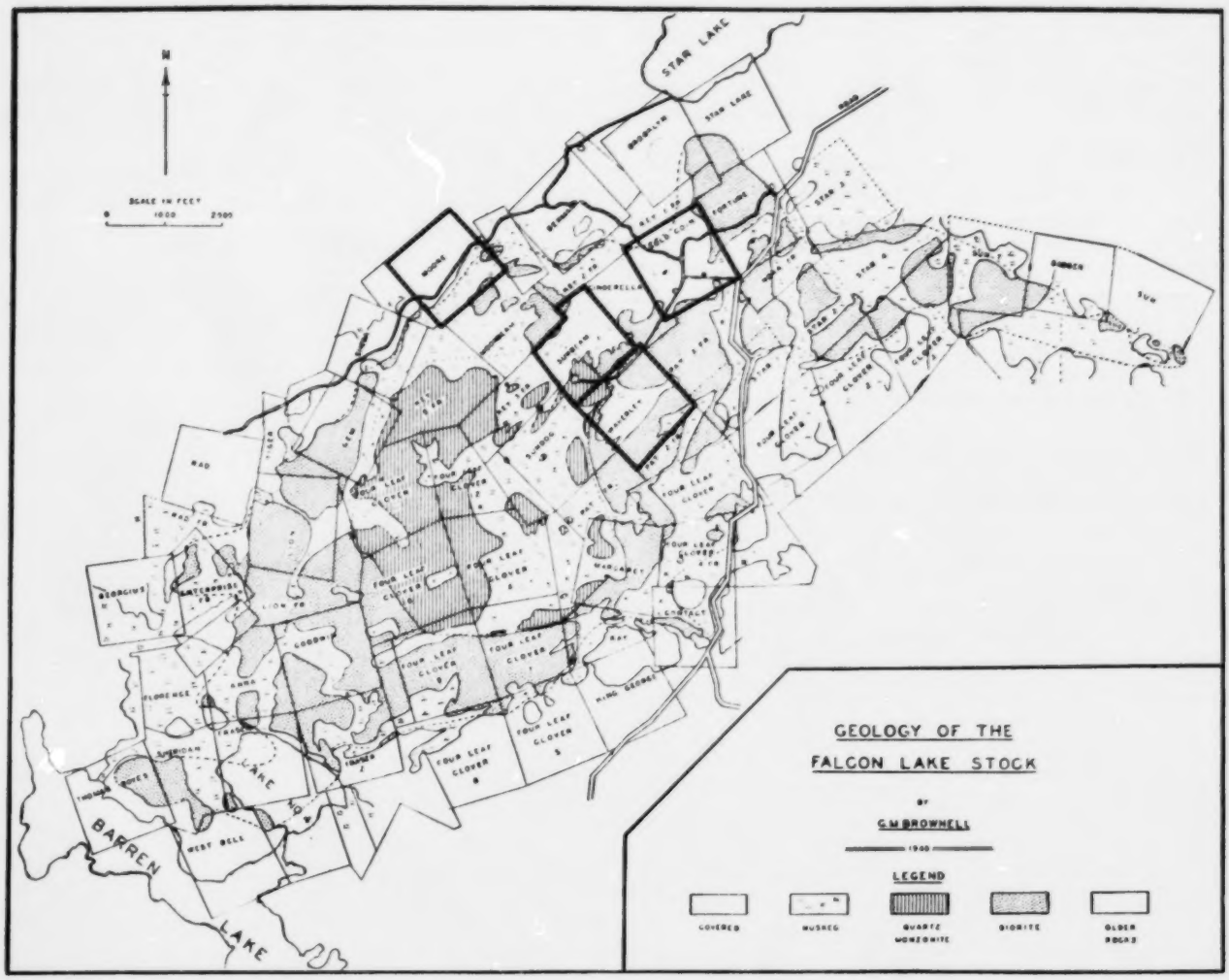

Figure 6: Geological sketch-map, Falcon Lake stock, showing location of claims (from Brownell, 1941).

West Hawk Lake-Falcon Lake Area

In the West Hawk Lake-Falcon Lake area, four small gold deposits (Gold Coin, Penniac Reef, Waverley, Sunbeam) are also historically known for their PGM occurrences in gold-bearing quartz veins located within the Falcon Lake Igneous Complex and/or the adjacent Keewatin Series mafic volcanic rocks. The Falcon Lake Igneous Complex (or Falcon Lake stock as shown in Fig. 6) consists of gabbro, diorite, granodiorite and quartz-monzonite (Brownell, 1941); the volcanic rocks include pillowed and massive andesite, basalt and rhyolite flows, basic agglomerate, and basic tuff (Davies, 1954). Platinum-group metals were reported in the area by French (1915), Marshall (1918), and McLaren (1929). The area was re-examined by Bruce (1919), Springer (1952), and Scoates (1987a), but no PGM were found.

Gold Coin claim (N.T.S. 52E/11NE; Map A, location no. 1)

The property is located 800 m south of Star Lake, 2.4 km southwest of West Hawk Lake, and approximately 1.2 km east of the Penniac Reef property (Mineral Inventory card 52E/11 AU 11).

A sample of a quartz vein in granite, carrying small quantities of pyrite and arsenopyrite assayed 3.429 g/tonne (0.10 oz/ton) platinum, with a trace of silver, and 78.86 g/tonne (2.30 oz/ton) gold (Marshall, 1918). The area is underlain by granodiorite (Bruce, 1919). A 0.91 m wide, 18.3 m long, mineralized glassy quartz vein partly replacing a small shear zone occurs on the property; pyrite and arsenopyrite occur in the vein and wall-rock (Marshall, 1918).

Penniac Reef (Moore) property (N.T.S. 52E/11NW; Map A, location no. 2)

The property is located 132 km east of Winnipeg, 800 m southwest of Star Lake, and 3.2 km north of the Trans-Canada Highway.

On the Penniac Reef property, quartz stringers occur in sheared basic agglomerate (Davies, 1954, p. 24). The shear zone strikes 035°-045° and dips 20-60° NW. Minerals present include gold, pyrite, chalcopyrite and pyrrhotite (Wallace, 1912).

The property was first staked as the Moore claim in 1890. The gold deposit was developed from 1911 to 1915 by Penniac Reef Gold Mines, Limited and approximately 3.1 kg (100 oz) of gold was produced (Mineral Inventory card 52E/11 AU 4). The second gold bar, produced in 1915, had three 0.2 gram assays done on it: the assays averaged 0.0985 g gold, 0.0045 g platinum, 0.0005 g iridium, 0.0310 g silver, and 0.0655 g of copper and iron together (French, 1915). French (1915) notes that iridium compounds were combined with much iron, forming iridium concretions during the melting process; he adds that platinum forms an alloy with the gold, and in the separation processes much of the platinum also remains with the iridium. In addition, a sample of concentrates was reported to contain gold, platinum, and iridium associated "in combination with much iron, sulphur, arsenic, etc."; on separation all of the platinum and iridium occurred in the magnetic portion.

Star Lake Gold Mines Limited obtained the property in 1917, and carried out some drifting. A sample from the dump returned an assay of 8.23 g/tonne (0.24 oz/ton) gold, with a trace of silver and platinum (Marshall, 1918). The mine was inactive from 1918 to 1929. High values of platinum and osmium were reported from one of two NE-SW-trending drifts on the first level of the mine (McLaren, 1929).

Waverley claim (N.T.S. 52E/11NW; Map A, location no. 3)

The property is located 1.2 km south of Star Lake, 3.2 km southwest of West Hawk Lake, and approximately 1.2 km southeast of the Penniac Reef property (Mineral Inventory card 52E/11 AU 3).

A sample of a quartz vein assayed 27.43 g/tonne (0.8 oz/ton) gold, with traces of platinum and silver (Marshall, 1918). The area is underlain by sheared granodiorite (Bruce, 1919) and sheared quartz monzonite (Brownell, 1941) containing gold mineralization. Bruce (1919) noted the mineralization over a length of 61.0 m in sheared granodiorite. Milky quartz veins and stringers were noted by Marshall (1918).

Sunbeam claim (N.T.S. 52E/11NW; Map A, location no. 4)

The Sunbeam property, which has yielded a small production of gold (Mineral Inventory card 52E/11 AU 2), is located about 800 m south of Star Lake, 3.2 km southwest of West Hawk Lake, and approximately 800 m southeast of the Penniac Reef property.

A sample taken from a 2.44 m deep pit in a NE-SW trending "hornblende granite" dyke assayed trace platinum with 94.29 g/tonne (2.75 oz/ton) gold, and 5.143 g/tonne (0.15 oz/ton) silver; both the dyke and the granite it intruded contain pyrite, bornite and chalcopyrite (Marshall, 1918). A gold-bearing quartz monzonite breccia pipe that is silicified, sericitized and slightly carbonatized occurs on the property (Brownell, 1941). Mineralization consists of pyrite, pyrrhotite, arsenopyrite, sphalerite, galena, tennantite, chalcopyrite and minor associated gold.

Bird River Greenstone Belt

The Bird River greenstone belt is an east-trending belt of mafic to felsic volcanic rocks and sedimentary rocks that have been intruded by gabbro, quartz-feldspar porphyry and diabase and by the Bird River Sill (Coats et al., 1979). The Bird River Sill is a layered mafic to ultramafic intrusion with an average thickness of 1000 m (Trueman, 1971), which outcrops along both limbs of an eastward plunging anticline (Bateman, 1943). PGM occurrences located near the south and north limbs of the Bird River Sill are shown in Figure 7.

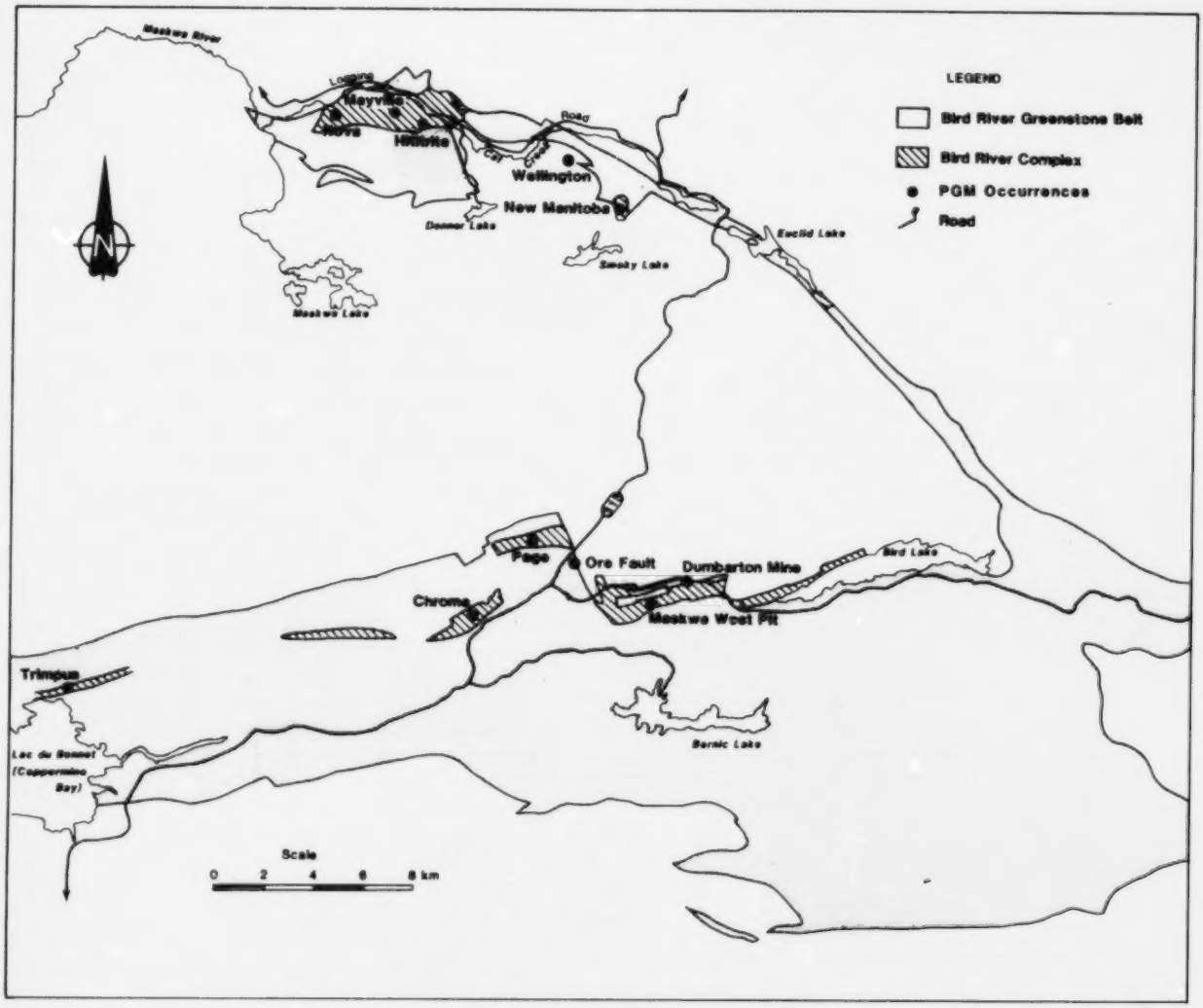

Figure 7: Location map of PGM occurrences, Bird River greenstone belt (modified from Theyer, 1986).

Two chromite deposits and one nickel-copper deposit associated with ultramafic rocks of the Bird River Sill, contain platinum-group metals. PGM are also associated with several gabbroic intrusions containing nickel-copper or chromite mineralization. PGM were produced from the Dumbarton nickel-copper deposit that is hosted by fine grained amphibolite (derived from andesite). The GSC and the Manitoba Government have been studying the area for its PGM potential (Theyer, 1981, 1986; Watson, 1983; Williamson, 1987).

Bird River Sill: South Limb Area

Dumbarton Mine Lease area (N.T.S. 52L/6NW; Map A, location nos. 10, 11)

The Dumbarton Mine Lease area consists of approximately 49 claims, and includes the Dumbarton Mine and the Maskwa West Open Pit. The Dumbarton Mine (Mineral Inventory card 52L/6 NI 1) is located about 4.8 km west of Oiseau (Bird) Lake, 5.6 km north of Bernic Lake and is crossed over by Provincial Road No. 315; the Maskwa West nickel deposit (Mineral Inventory card 52L/6 NI 2) is 1.2 km southwest of the Dumbarton Mine.

The Dumbarton nickel-copper deposit, as described by Karup-Møller and Brummer (1971), consists of four irregular-shaped lenses containing disseminated to massive sulphide ore, hosted mainly by fine grained amphibolite, derived from andesite. Mineralization consists of pyrrhotite, pentlandite, chalcopyrite, violarite and marcasite. Arsenic, gold, silver, lead and cobalt were found in trace amounts (McCann, 1921); chromite is also known to occur (Davies, 1955). Zinc was reported in fine-grained cherty beds (Karup-Møller and Brummer, 1971).

PGM were first reported in the area by Stanmore Mining and Smelting Limited, a company that had incorporated in 1937 to take over the holdings of Great Falls Mining and Smelting Company, Limited and Northfield Mining Company, Limited. The company's 'Oiseau property' consisted of 53 claims in the Oiseau (Bird) River area, many of which are found within the 'Dumbarton Mine Lease' area.

Work done on the Dumbarton property included 1737 m of diamond drilling on the Dumbarton, Chance, Martin, Colossus M.C., Colossus No. 12, 13, and 15 claims in 1936, with 184 m on the Colossus M.C. claim (Mineral Inventory card 52L/6 CU 2) in 1937. In a company report of Stanmore Mining and Smelting Limited, Browne (1938) reported that "traces of platinum group, gold, and silver were found in most of the Oiseau cores". In 1968, Consolidated Canadian Faraday Limited did 1219 m of drilling on the Dumbarton Mine property to confirm the nickel and copper reserves; platinum and palladium values were reported to be "interesting". Later, two random samples of flotation concentrate indicated metal contents (by weight) of: i) 4.69% Cu, 8.50% Ni, 1.234 g/tonne (0.036 oz/ton) Pt, 3.771 g/tonne (0.11 oz/ton) Pd; and ii) 5.96% Cu, 9.88% Ni, 1.097 g/tonne (0.032 oz/ton) Pt, 4.114 g/tonne (0.12 oz/ton) Pd (Karup-Møller and Brummer, 1971).

Small amounts of PGM by-products were produced from the deposit, which was mined for nickel, copper, cobalt, gold and silver from 1969 to 1973, by Dumbarton Mines Limited (Table 3). The deposit produced 1 539 000 tonnes of ore with an average grade of 0.81% Ni and 0.30% Cu (Fogwill and Bamburak, 1987, p. 25).

TABLE 3
Dumbarton Mine PGM production; 1970 - 1973

1970	18 662 g	(600 oz) PGM*
1971	24 882 g	(800 oz) PGM*
1972	24 882 g	(800 oz) PGM*
1973 (?)	9 700 g	(311.97 oz) palladium**

*Calculated using Pt/Ni: 0.0004 for 1970, and Pt/Ni: 0.0002 for 1971 and 1972 (Report of the Task Force, 1974).
**Consolidated Canadian Faraday Limited, Annual Report 1973.

The Maskwa West nickel-copper deposit was discovered by diamond drilling in 1974. It consists of a low-grade disseminated sulphide zone located within the ultramafic basal unit of the Bird River Sill; marcasite-pyrite, violarite, pentlandite, pyrrhotite and chalcopyrite occur in a matrix of talc, carbonate, chlorite, chrome spinel, secondary magnetite, and serpentine minerals (Coats et al., 1979). An open pit was developed on the orebody in 1975 by Dumbarton Mines Limited. Production consisted of 365 730 tonnes of ore with an average grade of 1.16% Ni and 0.20% Cu (Coats et al., 1979). A further 816 000 tonnes of ore grading 1.34% Ni and 0.23% Cu were delineated under the open pit (Northern Miner, July 15, 1976). Production ceased in 1976.

In 1986, old drill core from the Dumbarton Mine and Maskwa West pit areas was sampled by the Manitoba Government; drill core assays of up to 220 ppb Pt and 320 ppb Pd over 0.3 m intervals were reported. Results are shown in Table 4.

The GSC reported contents of up to 260 ppb Pt and 1760 ppb Pd in Ni-Cu ores from the Dumbarton Mine. The ore samples were obtained from ore collections of the GSC, and analyzed using a lead fire assay and carbon-rod atomic absorption spectrometry method. Results, representing heavy mineral concentrates, are shown in Table 5.

Chrome property (N.T.S. 52L/5NE; Map A, location no. 5)

The Chrome claims were staked approximately 400 m northwest of Peterson Creek, a tributary of the Oiseau (Bird) River, and 3.2 km southwest of the junction of Provincial Roads 314 and 315 (Mineral Inventory card 52L/5 CR 1).

Prior to 1981, the property was explored mainly for chromite. Bannatyne and Trueman (1982) estimated chromite reserves (measured and indicated) of 2 074 770 tonnes grading 18.2% Cr_2O_3. In 1981, the Manitoba Government sampled chromite and chromitite layers on the property for PGM analyses (Theyer, 1981). One sample yielded 1.6 ppm platinum (Theyer, 1982).

TABLE 4
Pt and Pd in ore of the Dumbarton Mine and the Maskwa West Pit
(from Theyer, 1986)

DDH#		Sample # From-To	Pt	Pd	Mineralization
FB 74/42	DM-1	204'-205'	30	64	3-5% py, minor cpy
FB 74/42	DM-2	209'-210'	< 20	63	2-3% py
FB 74/42	DM-3	225'-226'	< 20	16	1% py and cpy
FB 74/42	DM-4	229'-230'	20	66	2-4% py and cpy
FB 74/42	DM-5	233'-234'	40	61	2-3% py and po intergrown
FB 74/42	DM-6	241'-242'	30	75	5% py in clusters
FB 74/42	DM-7	296'-297'	30	320	7-8% py, minor po and cpy
FB 74/43	DM-9	307'-308'	50	210	3-5% diss. py minor cpy
FB 74/43	DM-10	319'-320'	60	280	1-2% diss. py
FB 74/43	DM-11	359'-360'	50	200	1% diss. py
B45	DM-12	321'-322'	< 20	7	1% diss. py
B45	DM-13	335'-336'	30	210	10-15% py and po
B45	DM-14	367'-368'	< 20	43	20-25% py and po
B48	DM-15	318'-319'	< 20	2	sporadic diss. py
B48	DM-16	322'-323'	< 20	26	10% diss. py
B48	DM-17	352'-353' and 357'-358'	220	190	10% py in clusters and veins
B50	DM-18	394'-395'	30	32	approx. 80% po

TABLE 5
Preliminary analyses of Ni-Cu ores from the Dumbarton Mine
(from Jonasson et al., 1987)

	As	Sb	Mo	Hg	Pt ppb	Pd ppb	Au ppb	Pt/(Pt+Pd)	Se	Te	Bi	U	Sample
	11	1	5	0.10	260	625	35	0.294	36	8	3	0.00	467
	1	1	5	0.21	255	1760	80	0.127	63	9	3	0.00	468
	3	1	5	0.16	90	1280	25	0.066	-	0	3	0.05	469
	3	1	5	0.08	0	500	40	0	33	0	3	0.08	470
	1	1	3	0.06	0	465	25	0	48	0	3	0.00	537
Mean Values	1	1	3	0.12	121	926	41	0.116	45	3	-	-	
D.L.	1	1	3	0.01	5	5	5		1	1	3	0.005	

- indicates no data; D.L. = detection limits; values in ppm unless noted.

The Geological Survey of Canada and the Manitoba Government have been doing extensive research of the chromite and PGM deposits of the Bird River Sill (BRS) since 1982, using rock samples from the Chrome property where a large portion of the thickness of the BRS is exposed. A 200 m long channel sample representing 400 m of the thickness of the BRS, was cut in the east part of the claim, over a 2-5 cm width and a 6 cm depth, in 1982-1983; this was followed by a 160 m long channel sample in the west part in 1984 (Theyer, 1983, 1984, 1985a). Initial lab work consisted of isolating anomalous sulphur samples over 10 m intervals and then over successively smaller intervals followed by fire assaying of sulphide-rich zones for PGM (Theyer, 1982); PGM analyses by Bondar-Clegg & Company Ltd. were done using an aqua regia-fire assay - DC plasma method and a multiple acid digestion-atomic absorption method (Theyer, 1985a). Samples were also collected by D.M. Watson and R.W. Talkington (Watson, 1982, 1983). Additional sampling was done in 1987 for whole rock and PGE analyses, and petrographic work (Williamson, 1987).

Microprobe studies of samples done at the Bureau de Recherches Géologiques et Minières - Centre National de la Recherche Scientifique (BRGM-CNRS) facilities in Orléans, France, resulted in the discovery of PGM and PGM alloy inclusions throughout the chromitite zone in 1982 (Talkington et al., 1983). The study was partly funded by RioCanex Limited and the Ontario Geological Survey. Another PGM inclusion study was done by Ohnenstetter et al.(1986) using samples of chromite from the easternmost trench on the claim; the study was funded by the GSC and the Engineering Research Council, Canada.

According to the platinum-group element (PGE) studies, the deposit occurs within a 'differentiated ultramafic to mafic layered intrusion of Archean age' known as the Bird

River Sill (or Bird River Complex, Theyer 1985a) (see Fig. 7 and Fig. 8). The sill consists of a basal sulphide unit where pyrrhotite, pentlandite, chalcopyrite, pyrite occur (Talkington et al., 1983); a lower ultramafic series about 200 m thick, which Trueman (1971) subdivided into 19 layers of serpentinized peridotite, 18 layers of interbanded chromitite and serpentinized peridotite, and an overlying pyroxenite layer (as many as 35 chromitite layers occur in the upper 60 m of the series, Duke et al., 1986); and an overlying layered gabbroic series approximately 380 m thick consisting of anorthosite, anorthositic gabbro, hornblende gabbro and porphyritic gabbro (Trueman, 1971). Associated minerals or products of value on this property include chromium, titanium, magnesium, manganese, aluminium, iron (Bateman, 1943, p. 174).

Theyer (1985a) subdivided the ultramafic part in two channel-samples into 13 magmatic cycles based on crystal morphologies. The cycles are 1.5 to 46 m thick, and average 13 m; PGM mineralization varies vertically and laterally with the cycles. Lateral variation in PGM content is shown by a sulphide and chromite-rich layer (in the western part of the property) that returned up to 179 ppb Pt and 532 ppb Pd; fifty metres east, the same layer contained up to 511 ppb Pt and 1145 ppb Pd.

According to Theyer (1985a), "Pt and Pd concentrations vary between each cyclic unit and correlate with abundances of S, Cu and Ni." Discrete sulphide layers are known to occur in the eastern and western parts of the property (Scoates, 1983); those layers in the gabbroic section are thought to be potential collectors and carriers of PGM's (Theyer, 1983).

Platinum-group metal mineralization is known to occur in the ultramafic series (Fig. 8) within and below a chromitiferous zone that, according to Scoates (1983), comprises six suites: upper chromitites, upper main chromitite, banded layer-diffuse layer, lower main, disrupted layer, and lower chromitites. Assays of 66 samples returned up to 100 ppb Os, 53 ppb Ir, 510 ppb Ru, 160 ppb Rh, 720 ppb Pt, 1800 ppb Pd, 520 ppb Au; all six platinum-group elements were associated with chromite (Hulbert et al., 1988, p. 49).

PGM inclusions were identified in samples from the upper chromitiferous zone. Talkington et al.(1983) found laurite (Ru, Os, Ir) S_2 inclusions that are Ru-rich (containing up to 2.99 wt% Pd), and rutheniridosmine (Os, Ir, Ru alloy) inclusions that are Os-Ir-rich, in chromite from chromite seams. In addition, it was reported that Ru/Ru+Os+Ir increases from 157 m to 187 m and decreases from 187 m to 203 m above the "base" of the ultramafic zone. Laurite was also found "attached to and in amphibole inclusions" in a 3.1 m thick upper main chromitite suite (Ohnenstetter et al., 1986).

The general trend of PGE in laurite was reported (in order of abundance) as Ru, Os, Ir, Rh, Pd, and Pt (Ohnenstetter et al., 1986). However, microprobe data also indicated cyclicity in olivine and chromite cumulates of Ru/Os in laurite: in 3 cycles the evolution was from Ru-rich to more Os-rich compositions. It was reported that the Os content of laurite varies directly with Mn and indirectly with the Ti content in chromite (Ohnenstetter et al., 1986).

PGE have also been reported in the disrupted layer suite, but most consistently in the lower chromitites group which has a known strike length of 800 m, a thickness of up to 3 m, and a high Os, Ir, Ru content (Hulbert et al., 1988). The mineralization extends into the underlying sulphidic peridotite that is known to contain high Ni-Cu grades, and high Pt-Pd contents (Hulbert et al., 1988). According to Hulbert et al.(1988, p. 52), all six PGE were accounted for by the following PGM's (in approximate order of abundance): sperrylite ($PtAs_2$), kotulskite (PdTe), merenskyite ($PdTe_2$), laurite (RuS_2), hollingworthite (RhAsS), irarsite (IrAsS), keithconnite (Pd_3-xTe), and mertieite II (Pd_8Sb_3). Common associations for the PGM are silicate gangue (77% by volume), sulphides (22%), chromite and magnetite (less than 1%) (Hulbert et al., 1988).

PGM mineralization also occurs below the chromitiferous zone (Fig. 9). Two PGM-enriched zones were reported in the western part of the property. The first zone, located at 32.3 - 52.3 m above the base of the ultramafic zone, returned up to 99 ppb Pt, 364 ppb Pd in 2 m-interval assays (Theyer, 1985a), and showed a correlation between Pt, Pd and Cr (Theyer, 1984) and the second zone at 93.7 - 111.7 m returned up to 51 ppb Pt, 203 ppb Pd in 2 m-interval assays, and up to 123 ppb Pt, 461 ppb Pd in 50 cm-interval assays. These zones coincide with four igneous cycles (Nos. 3, 4 and 11, 12, respectively) identified by Theyer (1985a). In the eastern part of the property, a Pt-Pd-Cr correlation was reported in one interval of the ultramafic zone, and values of up to 123 ppb Pt, 337 ppb Pd were found in a more "diffuse distribution pattern" than in the western part of the property, in several igneous cycles.

Page claim (N.T.S. 52L/5NE; Map A, location no. 6)

The Page No. 1 (W8692) claim is located about 2.4 km northeast of the junction of Provincial Roads 314 and 315, and about 500 m northwest of Peterson Creek, a tributary of the Oiseau (Bird) River.

The chromite deposit on the property is situated within a serpentinized peridotite near the center of the Bird River Sill, which intruded into the metavolcanic part of the Rice Lake Series. Chromite and chromite-bearing peridotite occur as layers in a 762 m main band that averages 2.0 m wide, strikes westerly and dips 60-85° S (Bateman, 1943).

The zone, which is segmented by closely-spaced faults, extends for a length of 3050 m in the area of the Page, Buhr and Cap claims (Bannatyne and Trueman, 1982), and is similar to that on the Chrome property (Bateman, 1943). These properties are described in more detail in Mineral Inventory cards 52L/5 CR 2, CU 3, CU 4, CR 1, respectively.

Nickel (1.03%) and copper (up to 4%) were reported in altered gabbro, as well as nickel (up to 0.5%) and chromite (3.07% Cr_2O_3) in altered peridotite (Dawson, 1942). Total chromite reserves (measured and indicated) in the main zone were calculated at 1 583 186 tonnes **in situ**, undiluted grading 25.5% Cr_2O_3 (Bannatyne and Trueman, 1982). Associated minerals or products of value on the

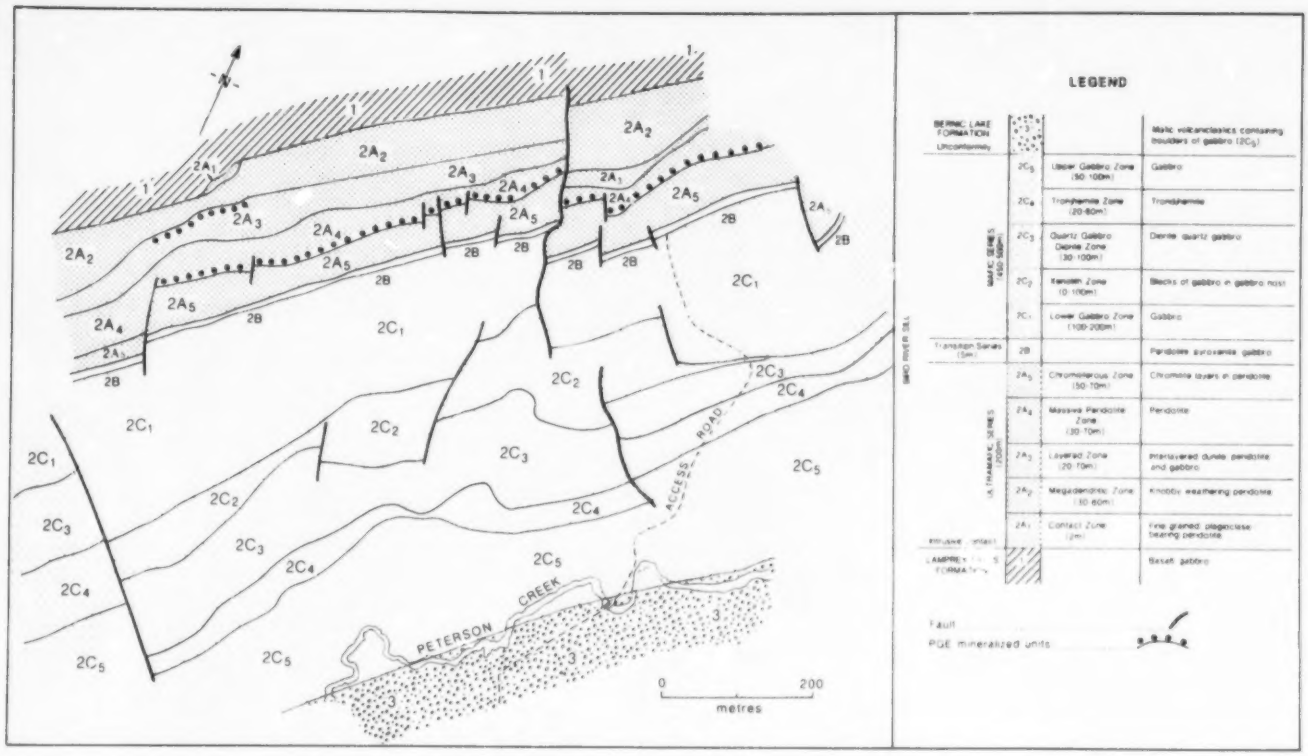

Figure 8: Geology of the Chrome property, and location of PGE mineralized units (from Hulbert et al., 1988).

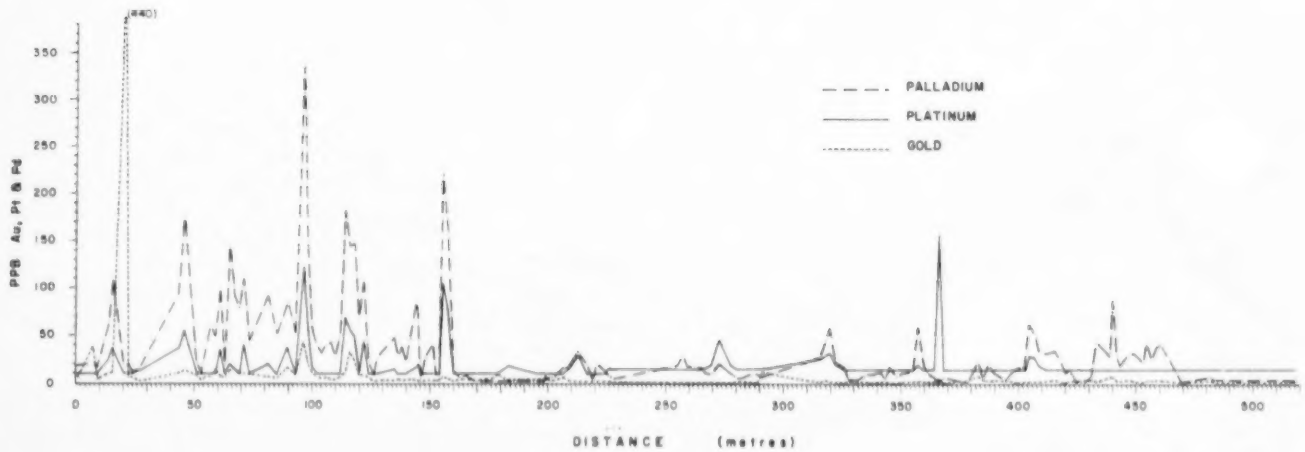

Figure 9: Pt, Pd and Au concentrations across the thickness of the Bird River complex in the vicinity of the Chrome property (from Theyer, 1986).

property include: titanium, magnesium, nickel, manganese, aluminium, phosphorus, iron and platinum (Bateman, 1943).

Traces of platinum were reported in an average of several partial analyses of dense chromite ore from the Page property, by Hudson Bay Mining and Smelting Co., Limited (Bateman, 1943, p. 173). Later, D. Raicevic (1975) of CANMET, noted that "base-metal deposits containing Cu, Zn, Ni with small amounts of platinum and palladium" occur 1.6 km north of the junction of the Cat Lake and Bird Lake roads (note: this may have been in reference to the Ore Fault property).

Bird River Mines property (Ore Fault group) (N.T.S. 52L/5NE; Map A, location no. 7)

The property, assumed to be the Ore Fault (previously Lucky Boy) group of sixteen claims, is located about 8 km west of Oiseau (Bird) Lake, 1.5 km north of Provincial Road No. 315 and 500 m southeast of Provincial Road No. 314. It is about 4.1 km west-northwest of the Dumbarton Mine and 1.5 km southeast of the Page property. The property has been explored mainly for base metals (Mineral Inventory card 52L/5 NI 1).

The area, as described by Ritchie (1973), is underlain by a fault block of metavolcanic and metasedimentary rock, and ultramafic rocks of the Bird River Sill. The block is bounded by a granitic intrusion to the southeast, east and north, and a major northwest-trending fault (Ore Fault) to the west. Mineralization (pyrrhotite, pyrite, pentlandite, sphalerite, chalcopyrite, ilmenite, chromite, magnetite, violarite and smythite) is associated with a series of shears in metavolcanic rocks (fine grained pillow lava, chlorite schist, and massive coarse grained amphibolite). Cobalt and silver are also reported to occur (Mineral Inventory card 52L/5 NI 1).

On the Ore Fault claim Nos. 20 to 29, Bird River Mines Co. Ltd. carried out trenching in 1969 and diamond drilling in 1969-1971 (Financial Post Survey of Mines, 1971). The drilling outlined the mineralized zone over a length of 244 m, an average width of 12 m and a depth of at least 122 m. A 29.3 kg (64.5 lb) sample of split drill core was sent to the Mineral Processing Division of the Department of Energy, Mines & Resources in Ottawa for mill tests. Analytical results indicated the mineralized zone, "if continuous....would contain 3120 tons per vertical foot grading 0.53% nickel and 0.19% copper...and about 1$ per ton in cobalt, with additional values in platinum" (Northern Miner, January 14, 1971).

CANMET apparently did some lab-work on a Cu-Ni-Zn deposit of the Bird River Mining Company (Raicevic, 1975, p. 8). Cu-Ni ore samples from the Lucky Boy claim area were recently tested by the GSC but no platinum values were reported (Jonasson et al., 1987).

Trimpus claim (N.T.S. 52L/5NW; Map A, location no. 8)

The property is located 1.61 km northeast of Coppermine Bay on Lac du Bonnet; 3.2 km north and 1.1 km west of the mouth of the Oiseau (Bird) River. It is adjacent to the Wards claim (Mineral Inventory card 52L/5 CR 3) and near the southwestern end of the south limb of the Bird River Sill. The history of exploration in this area is detailed in Mineral Inventory card 52L/5 PT 2.

The area (as described in Non-confidential Assessment File No. 91382) is underlain predominantly by mafic volcanics containing minor disseminated magnetite and pyrrhotite. Other rock types include felsic volcanics (dacitic flows, tuffs, agglomerates, rhyolite), felsic intrusions (granitic rocks, felsite dykes, quartz-feldspar porphyry dykes), and narrow discontinuous quartz veins. Gabbroic sills in the area follow the N75°E trend of near-vertical dipping volcanic rocks, and occur near the contact of mafic and felsic volcanics.

The occurrence is in a gabbroic sill that extends for just over 3.2 km and reaches inferred widths of up to 457 m. Three varieties of gabbro were mapped: fine grained; medium- to coarse-grained; and porphyritic (or anorthositic) gabbro. The gabbro contains sulphides (pyrrhotite, pyrite or chalcopyrite) and chromite (Non-confidential Assessment File No. 91382). The chromite-bearing gabbro may be "a rock unit separate from, and not a part of, the Bird River Sill" (Bannatyne and Trueman, 1982).

In 1973, PGM mineralization was found in a 213.4 m deep drill hole (ddh Mac-1) that was drilled in a NNW direction at -45° by Canex Placer Limited. A 12.2 m long drill core intersection of gabbro containing stringers and blebs of pyrrhotite, chalcopyrite, and carbonate, returned assays of up to 1.37 g/tonne Pt and up to 1.71 g/tonne Pd (Non-confidential Assessment File No. 91382). Results are shown in Table 6.

In 1986, the Manitoba Government collected rock samples, for PGM analyses, at 1 m intervals along the edges of two pits near the Canex Placer drilling (Theyer, 1986). The sampled rocks were "foliated coarse-grained hornblende-bearing gabbro containing minor amounts of disseminated pyrite". Assay results indicated a maximum of 540 ppb Pt and 780 ppb Pd from sulphide-rich samples (Table 7).

Winnipeg River area (N.T.S. 52L/5, 6?; Map A, location no. 9)

The following excerpt is from the Canadian Mining Book (1930): "Shatford Basin Mines, Limited .... Property, 37 claims, about 1900 acres (769 ha) in the Shatford, Bernic and Birse Lakes area in south-eastern Manitoba. Minerals contained, Copper, nickel, beryl, tin, platinum, gold".

Other:

In 1981, chromitite layers in the National-Ledin (Mineral Inventory card 52L/5 CU 6) claim area were sampled for PGM analyses (Theyer, 1981). Results have not been reported.

TABLE 6
Assay Results for ddh Mac-1, Trimpus claim area
(from Manitoba Mines Branch, Non-confidential Assessment File No. 91382)

Drill core depth (feet)	(metres)	%Ni	%Cu	%Cr	Pt g/tonne (oz/ton)	Pd g/tonne (oz/ton)	%Co	Au g/tonne	Ag g/tonne
196-	59.7-				1.37	1.71			
206	62.8	0.28	0.42	0.76	(0.04)	(0.05)	0.03	Tr	Tr
206-	62.8-				0.686	0.686			
216	65.8	0.21	0.47	0.05	(0.02)	(0.02)	0.03	Tr	Tr
216-	65.8-				1.37	1.71			
226	68.9	0.28	0.42	0.76	(0.04)	(0.05)	0.03	Tr	Tr
226-	68.9-				0.686	0.686			
236	71.9	0.19	0.37	0.99	(0.02)	(0.02)	0.03	Tr	Tr

Note: chromite was visibly noted in the core at drill depths of 62.2 m, 62.8 m, 70.1 m.

TABLE 7
Pt and Pd in rock samples from pits near the Canex Placer drilling
(from Theyer, 1986)

	Sample#	Pt	Pd
Pit #1	SF 2	230	300
	SF 3	540	780
	SF 4	170	350
	SF 5	370	680
	SF 6	210	470
	SF 7	340	690
Pit #2	SF 9	10	28
	SF 10	< 10	82
	SF 11	160	360

Note: Analytical results expressed in ppb. Analyses performed by Neutron Activation Services Ltd., Hamilton, Ontario using lead fire assay concentration followed by DCP analysis. Normal minimum detection limits: 10 ppb Pt and 2 ppb Pd; however, detection limits can be higher due to sample composition.

Bird River Sill: North Limb Area

Hititrite M.C. claim (N.T.S. 52L/12NE; Map A, location no. 14)

The Hititrite M.C. (27704) claim is located approximately 1.3 km southeast of the Mayville M.C. claim, 4 km north - northwest of Donner Lake and 6.5 km east of the junction of Maskwa River and Cat Creek. The history of exploration work on the property is detailed in Mineral Inventory card 52L/12 PT 1.

Two samples of "mineralized norite" from the Hititrite claim, containing pyrrhotite, pentlandite and chalcopyrite, returned assays of 3.23% Cu, 0.59% Ni, 0.02% Pt, and 0.68% Cu, 1.68% Ni, 0.01% Pt, respectively (McCann, 1921). Cooke (1922, p. 18) noted that the "norite" is actually a gabbro. The property contains a mineralized (iron-nickel-copper) zone, approximately 20 m x 40 m in size, hosted by a medium- to fine-grained gabbro (Theyer, 1986).

In 1986, the Manitoba Government collected forty-six samples, for PGM analyses, at 50 cm intervals from the edges of five shallow pits and trenches. The samples were analyzed by Neutron Activation Services using a lead fire-assay concentration method followed by DCP analysis (Theyer, 1986). Results indicated a maximum of 520 ppb Pt and 710 ppb Pd.

Nova claim (N.T.S. 52L/12NE; Map A, location no. 16)

The Nova claim (Claim No. 27814) is located approximately 2.4 km west of the Mayville claim and 2.75 km northeast of the junction of Maskwa River and Cat Creek.

A sample of "mineralized norite" returned an assay of 1.84% Cu, 0.36% Ni and 0.03% Pt (McCann, 1921). Mineralization consists of pyrrhotite, pentlandite, and chalcopyrite. Cooke (1922) noted that the "norite" is actually a gabbro.

Wellington and Bird claims (N.T.S. 52L/11SW, 11NW, 12SE; Map A, location no. 13)

The Wellington group (Wellington Nos. 7 to 18) and the Bird group (Bird, Bird Nos. 1 to 11) of twelve claims, were staked over an area extending from 2.5 to 4.4 km west-northwest of Cat Lake (Manitoba Mines Branch, Mining Recording, Claim maps 52L/11 NW, 11 SW, 12 SE, circa 1933). The deposit apparently lies between Backus-McLeod Exploration Company Limited's Wellington Group and The Bear River Copper Company's Bird Group, and was probably shared by the two companies.

A 1929 company report of Backus-McLeod Exploration Company Limited (formerly, Winenglish Rivers Exploration and Mining Company, Ltd.) reported assays of "over 9 $ in copper, nickel, gold, silver and platinum" from the Wellington group of claims where a mineralized zone is approximately 91.44 m wide and 1219.2 m long. The zone contains mainly magnetite, pyrrhotite, chalcopyrite, "nickeliferous" pentlandite. Nickel and copper combined is apparently 2%; "gold, silver, platinum values are also found" (Manitoba Mines Branch, Corporation File, Backus-Mcleod Exploration Company Limited).

The Bear River Copper Company Limited also reported a main ore zone, 1219.2 m long and up to 152.4 m wide, containing copper and "small values" of gold, silver, and platinum (Winnipeg Free Press, May 6, 1933). The company was exploring the Bird group of claims.

The exact location of the mineralized zone is not known. It may be located on the Bird Nos. 4 and 6 (W10737, 39) and Wellington Nos. 8 and 10 (W10893, 95) claims, where occurrences of nickel and copper were reported in 1929 (Mineral Inventory card 52L/11 CU 1, remarks). These claims are found approximately 3.2 km northwest of the New Manitoba copper-nickel deposit (Mineral Inventory card 52L/11 CU 1), and from 0.8 to 1.8 km northwest of another nickel-copper occurrence (Mineral Inventory card 52L/11 CU 2) located on the Wellington Nos. 13 and 14 (W10898, 99) claims.

Mayville M.C. claim (N.T.S. 52L/12NE; Map A, location no. 15)

The Mayville M.C. claim is located about 5.6 km north-northeast of Maskwa Lake, 8.8 km northwest of Smoky Lake, and 8.8 km from the north end of Provincial Road No. 314.

The property contains a mineralized zone, approximately 35 m x 60 m in size, that is hosted by an "inhomogeneous gabbro" (Theyer, 1986). Mineralization includes pyrrhotite, pentlandite, chalcopyrite and titaniferous magnetite (Springer, 1950, p. 3). Chromite has been noted in gabbro (Bateman, 1943) and in peridotite (Springer, 1950). Wright (1930, p. 164) reported that 1923 drill core contained "alternating gabbro dykes and andesite".

The property was first staked in 1917. In the middle and late 1920's, trenching and diamond drilling was done on the Mayville and surrounding claims, and a large low-grade copper-nickel orebody was proved; surface samples were reported to contain up to 3.5% and 1.5% Ni (Non-confidential Assessment File No. 92088). Reserves of 272 232 tonnes grading at least 2% nickel-copper were reported in 1935 (Mineral Inventory card 52L/12 CU 2).

Chromite and chromitite layers in the Mayville area, were sampled for PGM analyses (Theyer, 1981). In 1986, the Manitoba Government collected fifty-two grab-samples, at 1 m intervals, from four north-trending and three west-trending trenches, for further PGM studies. The samples were analyzed by Neutron Activation Services using a lead fire-assay concentration method followed by DCP analysis (Theyer, 1986). Analytical results indicated a maximum of 210 ppb Pt and 570 ppb Pd.

New Manitoba (N.T.S. 52L/11SW; Map A, location no. 12)

The property is located 2.4 km southwest of Cat Lake and just south of Provincial Road No. 314.

The area is underlain by a small gabbro plug (in basalt) with disseminated copper-nickel mineralization (Davies et al., 1962, p. 43). Sulphides include chalcopyrite, pentlandite and pyrrhotite (Springer, 1950, p. 5). The gabbro plug is 335 m long and 122 m wide (Manitoba Mines Branch, Corporation File, Cat Lake Mines Limited). Reserve estimates have varied from 583 200 tonnes to 600 000 tonnes grading 0.24% Ni and 0.58% Cu (Mineral Inventory card 52L/11 CU 1).

In 1986, the Manitoba Government collected three channel samples of fine- to coarse-grained gabbro for PGM analyses. The samples were analyzed by Neutron Activation Services using a lead fire-assay concentration method followed by DCP analysis (Theyer, 1986). Results indicated a maximum of 40 ppb Pt and 68 ppb Pd.

Other:

In 1981, the Manitoba Government sampled chromitite layers in the Euclid (Mineral Inventory card 52L/11 CR 1) Lake area for PGM analyses (Theyer, 1981). Results have not been reported.

Rice Lake Greenstone Belt

The Rice Lake greenstone belt extends from Lake Winnipeg to Ontario. Two outlying greenstone belts at English Lake and at Wallace Lake are separated from the main belt by a major east-west fault (McRitchie, 1971, p. 8).

The Rice Lake belt is a sequence of volcanic and sedimentary rocks of the Precambrian Rice Lake Group that have been intruded by gabbroic and diabasic sills and dykes, felsic plugs, granitoid plutons, quartz-feldspar porphyry dykes and minor ultramafic bodies (Richardson and Ostry, 1987). The sequence is overlain unconformably by sedimentary rocks of the San Antonio Formation (McRitchie, 1971).

In the Stormy Lake area, PGM was found in association with gold-bearing quartz veins in gabbro. At English Lake, where several pyroxenite bodies are known to occur (Scoates, 1971), PGM was detected in "hornblendite" drill core containing nickel-copper mineralization. The Manitoba Government has been studying the region for its PGM potential since 1986 (Theyer, 1986, 1987).

Mirage property (N.T.S. 52L/14SW; Map A, location no. 17)

The property is located approximately 1 km east of Bidou Lake, and 2.2 km northwest of Stormy Lake. The area contains gold-bearing quartz veins that occur within sheared metagabbro (Mineral Inventory card 52L/14 AU 3). The shear zone occurs over a distance of 609.6 m, averages 1.8 m wide, and strikes 280°/40-70° N (Wright, 1932, p. 76). Ankerite, calcite, chlorite, fuchsite, and coarse tourmaline are found in white and smoky quartz (Stephenson, 1972). Sulphide mineralization consists of sparsely disseminated pyrite and pyrrhotite (Theyer, 1988).

A limited platinum sampling program was carried out in 1988 by the Manitoba Government: one of the four samples collected from the property returned concentrations of 300 ppb Pd, 20 ppb Pt, and 6900 ppb Au (Theyer, 1988).

English Lake area (N.T.S. 62P/1NE; Map A, location no. 18)

Traces of palladium were reported in one of seven drill holes drilled by Falconbridge Nickel Mines Limited in an area located approximately 2 km southwest of English Lake, and 32 km west-northwest of the town of Bissett (Occurrence No. 6 of Theyer, 1980, pp. 20, 57).

Drill hole ddh no. 1 intersected hornblendite at a depth of 60.96 m. According to Karup-Møller (1969), "Two mineralized fractures were intersected. They vary in width from one to three feet (0.3-0.91 m) in width and contain, on average, 4.5% Ni, up to 0.1% Co and trace amounts of Ag and Pd."; copper content varied from 0.1% to 1.2%. The sulphides in this hole are apparently intensely altered. Primary sulphides include pentlandite, chalcopyrite, and pyrite; secondary sulphides are violarite, marcasite, bravoite, pyrite, and minor chalcopyrite and hematite.

Other:

PGM exploration projects were carried out on the southeast shore of English Lake (N.T.S. 62P/1NE), and in the Shallow Lake (including part of Rice River) area (N.T.S. 62P/8SW), but no platinum was found (Theyer, 1986, 1987).

The 'Donner option' group of claims (N.T.S. 62P/1NE), located east of English Lake and north of Wanipigow Lake, is currently being investigated for its PGM potential (Theyer, 1987).

Theyer (pers. comm., 1987) noted that the Manigotagan area could be a potential site for platinum placer deposits. Drilling in 1959 on the Water Parcel claims (located 9.5 km northwest of the town of Manigotagan and 19 km west of English Lake) indicated that the core from Hole No. 9-23 'may' have been assayed for platinum, although no results were reported (Non-Confidential Assessment File No. 91213; Mineral Inventory card 62P/1 NI 3).

Theyer and Gaba (1986) noted that a potential PGM exploration target is the Tut claim area (N.T.S. 52L/14SE) located 1.6 km south of Stormy Lake and 3.8 km west of Garner Lake (Mineral Inventory card 52L/14 AU 2, remarks).

Knee Lake-Gods Lake Greenstone Belt

The Knee Lake - Gods Lake greenstone belt is one of several greenstone belts in the northern part of the Superior Province. The belts extend for about 500 km from Cotton Lake in Manitoba to Big Trout Lake in Ontario (Gilbert, 1985). Rocks in the belt include basalt, andesite, rhyolite and dacite flows, medium to coarse-grained gabbro, volcanic fragmental rocks, and minor ultramafic and sedimentary rocks of the Hayes River Group, which have been intruded by plutons and batholiths of the Bayly Lake Complex. The sequence is overlain unconformably by volcanic and sedimentary rocks of the Oxford Lake Group. Diabase, gabbro, olivine norite, granite, and granodiorite have intruded Oxford Lake Group rocks (Gilbert, 1985). Hayes River Group volcanics in the southern Knee Lake area exhibit "cyclical mafic to felsic differentiation sequences" (Richardson and Ostry, 1987; Gilbert and Elbers, 1972; Hubregtse, 1978).

Traces of PGM were reported from two claims located near the north shore of the southern part of Knee Lake. The claims had been drilled by Canadian Nickel Company Limited in 1960. The drill core consisted of volcanic and metasedimentary rocks with pyrite mineralization.

Kul No. 2 claim (N.T.S. 53L/15NW; Figure 1)

The property is located 4.5 km southeast of Cinder Lake and 5.1 km west-northwest of the junction of Wolf River and Knee Lake.

Drill hole ddh no. 15487, drilled to a depth of 28 m, intersected limestone, slate, graphite, bands of pyrite, and massive to disseminated pyrite. Drill core assays of up to 0.034 g/tonne (0.001 oz/ton) Pt and 0.034 g/tonne Pd, with 0.034 g/tonne Au, were reported (Non-confidential Assessment File No. 91195).

Note: original measurement units for Pt and Pd (not specified in the assessment files) are assumed to be in oz/ton.

Nee 15 claim (N.T.S. 53L/14SE; Figure 1)

The property is located 18 km southwest of the Kul No. 2 claim and 5.8 km northeast of the junction of Hayes River and Knee Lake.

Drill hole ddh no. 15478, drilled to a depth of 102 m, intersected quartzite, slate, acid volcanics (rhyolite or tuff), carbonate bands and stringers, and pyrite. Drill core assays of up to 0.034 g/tonne Pd, with 0.034 g/tonne Au, were reported (Non-confidential Assessment File No. 91192).

Note: original measurement units for Pd and Au (not specified in the assessment files) are assumed to be in oz/ton.

Other Explored Areas

Island Lake area (N.T.S. 53E; Figure 5, location no. 7)

Theyer (1985c, p. 17) examined ultramafic rocks of the Island Lake area; the PGM potential of the area was considered to be low. Bighorn Development Corporation is apparently evaluating "copper-nickel showings with associated platinum values along a band of ultramafic rocks" in the Island Lake area (Northern Miner, July 7, 1986).

Cross Lake (N.T.S. 63J/8-9; Figure 5, location no. 10)

The Manitoba Government is investigating anorthosite bodies in the Cross Lake region for platinum: "a sample from a 40 m long, 20 cm thick anorthosite layer containing disseminated sulphides" was sent for assay, (McRitchie, 1986) but gave nil results.

Neepawa area (N.T.S. 62J; Figure 5, location no. 2)

Old drill core sections of mafic to ultramafic rocks from the Neepawa area, which are stored in the Winnipeg Core library, Manitoba Mines Branch, were sampled for PGE analyses: poor results were obtained (Theyer, 1986).

Lynn Lake Greenstone Belt

The Lynn Lake greenstone belt is about 130 km long and up to 60 km wide (Fig. 10). The "greenstone" component of the belt consists of metavolcanic and metasedimentary rocks of the Wasekwan Group, which (according to Gilbert et al., 1980) form two northeast-trending belts: the northern belt and southern belt. Large composite plutons of diorite, tonalite, granodiorite, and granite were intruded between the two belts; Wasekwan Group rocks have been intruded by gabbro, norite, and minor ultramafics (Gilbert et al., 1980).

The Lynn Lake belt contains several nickel-copper deposits that have yielded small amounts of PGM by-products. These nickel ores are associated with two composite igneous plutons ('A' and 'El' plugs) that intruded Wasekwan Group rocks (Pinsent, 1980). Host rocks include gabbro, amphibolite, peridotite, norite and quartz-hornblende diorite (Phillips, 1979). PGM were found in "meta-pyroxenite" drill core containing pyrrhotite and chalcopyrite mineralization. The GSC recently investigated the region for its PGM potential, and found high levels of platinum and palladium in basaltic volcanic rocks of the area (Hulbert, 1988).

Lynn Lake area (N.T.S. 64C/9-12, 14-16; 64F/1; 64B/12-13; Figure 10)

The GSC examined selected intrusions (Tow Lake intrusion, Fraser Lake complex, Sickle Lake intrusion) in the Lynn Lake greenstone belt, and found that the basic and ultrabasic intrusions had low PGE values; contents of up to 63 ppb Pt, and 50 ppb Pd were obtained from the Sickle Lake intrusion (Hulbert, 1988). However, basaltic volcanic rocks from the Magrath, Barrington, Tod, Hughes, Miskwa, Cockeram and Hughes Lakes areas of the Lynn Lake greenstone belt, as well as from "Division B and D" of the northern belt, (analyzed for PGE by stable isotope dilution ICP-MS), were found to contain "very high levels" of Pt and Pd (Hulbert, 1988). The geology of this area has been described by several authors including Milligan (1960), Pinsent (1980) and Gilbert et al. (1980).

Lynn Lake mines (N.T.S. 64C/14SE; Figure 10, location nos. 1 and 2)

Lynn Lake is located approximately 241.4 km west-northwest of Thompson, Manitoba. The 'A' Mine shaft is located 700 m northeast of Lynn lake, and adjacent to the C.N. railway and Provincial Road No. 399. It is 1125 m north-northwest of the Farley Mine shaft. About 3.6 km south of the 'A' shaft is the 'El' Mine shaft which is approximately 650 m west of Eldon Lake.

The 'A' plug is a "composite ultramafic to intermediate igneous pluton (3.0 km x 1.5 km) intruded into Wasekwan Group metavolcanic strata" (Pinsent, 1980). It hosts twelve orebodies. According to Pinsent (1980, p. 9), "In some, the ore is restricted to the confines of discrete, subcircular mafic to ultramafic intrusions within the "A" plug host "gabbros" and amphibolites, and in others, the ore occurs directly within gabbroic host-rock". The ore consists of pyrrhotite, pentlandite, chalcopyrite, pyrite, minor cobalt, zinc, gold and platinum metals (Mertie, 1969), and traces of sphalerite, magnetite and ilmenite (Pinsent, 1980).

The 'El' deposit is in the central portion of a vertical, cylindrical pluton (about 500 m in diameter, on surface) consisting of a marginal unit of "contact-diorite" and a core unit of amphibolite, "peridotite" and minor "core-gabbro" (see Pinsent, 1980, p. 11). It is 914 m southeast of the 'A' plug. Mineralization is similar to the 'A' deposits, although the average grade of the ore is higher. Further details on the geology of these deposits can be found in reports by Emslie and Moore (1961) and Pinsent (1980).

The Lynn Lake property was explored, developed and mined mainly for its nickel-copper deposits by Sherritt Gordon Mines Limited (Pinsent, 1980; Mineral Inventory cards 64C/14 NI 1, NI 2). The Company produced 20 151 146 tonnes of ore averaging 1.023% Ni and 0.535% Cu from eleven orebodies in two igneous plutons ('A' and 'El' plugs). 'A' plug orebodies were mined from 1953 to 1969 with access through the 'A' shaft (collared in 1947) and from 1961 to 1976 through the Farley shaft (collared in 1955). The 'El' plug orebody was discovered in 1947 by diamond drilling, and was mined from 1954 to 1964. Some open pit mining was also carried out in these areas. Nickel, copper, cobalt, gold, silver and fertilizers were produced from these deposits.

Platinum was reported in concentrates from "earlier Sherritt nickel drilling" (Winnipeg Free Press, February 6, 1947). Production of nickel, copper and cobalt began in 1953; a small amount of platinum metals was apparently produced following improvements in milling (Mertie, 1969, pp. 18, 27; Report of the Task Force 1974, pp. 47, 54, 115; Hogan, 1974, p. 395).

Spectrographic analyses of nickeliferous sulphide ores from Lynn Lake indicated contents of 1.36 g/tonne palladium, 0.18 g/tonne platinum, and 0.018 g/tonne rhodium; pyrrhotite was the main mineral (Hawley and Rimsaite, 1953).

Ore samples from GSC collections were analyzed for PGM by lead fire-assay, and by carbon-rod atomic absorption spectrometric methods (Jonasson et al., 1987, p. 846). Results, representing heavy mineral concentrates, are shown in Table 8.

Tulune Lake area (N.T.S. 64C/15NE; Figure 10, location no. 7)

The Tulune Lake property (CB 2084) is located 1.6 km southwest of Tulune Lake, and 1 km north of Muskeg Lake. It is about 25.4 km northeast of the 'A' Mine at Lynn Lake. The history of exploration in this area is detailed in Mineral Inventory card 64C/15 CU 4.

Figure 10: Regional geological map of the Lynn Lake greenstone belt (from Pinsent, 1980).

Table 8
Preliminary results of analyses of Cu-Ni ores from Lynn Lake, Manitoba
(from Jonasson et al., 1987)

	As	Sb	Mo	Hg	Pt ppb	Pd ppb	Au ppb	Pt/(Pt+Pd)	Se	Te	Bi	U	Sample Number
	1	1	3	0.20	-	-	40	-	-	40	3	0.00	463
	1	1	5	0.25	0	80	25	0	42	39	3	0.10	450A
	1	1	10	0.23	5	30	30	0.143	36	40	3	0.00	450B
	1	1	10	0.20	1085	25	275	0.977	33	34	3	0.00	456C
Mean Values	-	-	7	0.22	-	45	93	-	37	38	-	-	
D.L.	1	1	3	0.01	5	5	5	-	1	1	3	0.005	

- indicates no data; D.L. = detection limits; values in ppm unless noted.

Note: The literature doesn't specify whether nickel ores that were used for PGM studies or PGM recovery, came from the 'A', 'El' or 'Farley' mines.

CB 2084 was staked by Wm. Daniels in 1969. A ten hole, 1514 m diamond drill program was completed that year. Hole no. R-10, drilled to a depth of 124 m, intersected sulphides over a 13.4 m length. The 70.4 to 71.6 m section of core assayed 0.01% Ni, 0.135% Cu, 0.06 g/tonne (0.04 dwts) Pd, 0.09 g/tonne (0.06 dwts) Pt; the 71.6 to 72.5 m section assayed 0.01% Ni, 0.222% Cu, 0.31 g/tonne (0.20 dwts) Pd. Spectrographic analyses of the 70.4 to 72.5 m section of core indicated 0.1-1% manganese, 0.01% zinc, trace silver and up to 0.01% vanadium. The sampled rocks consisted of medium grained meta-pyroxenite with pyrrhotite and some chalcopyrite and pyrite (Non-confidential Assessment File No. 91031).

Flin Flon-Snow Lake Greenstone Belt

The Flin Flon - Snow Lake greenstone belt is approximately 250 km in length, and from 32 to 48 km in exposed width (Bailes et al., 1987). It extends southward under Paleozoic cover. The belt consists of volcanic and derived sedimentary rocks of the Amisk Group, which are overlain unconformably by sedimentary rocks of the Missi Group. It contains a variety of intrusive rocks including large porphyritic felsic intrusions, several differentiated gabbroic intrusions, and large granodiorite bodies (Bailes et al., 1987).

In the Wekusko Lake area, PGM were found in gold-bearing quartz veins hosted by rocks such as andesite flows, biotite lamprophyre, and dacite or "quartz-eye" granite or porphyry. PGM were found in ultramafic rocks near the base of a layered intrusion in the Reed Lake area. PGM were reported from the Flin Flon copper-zinc deposit that is hosted by a rhyolite flow and flow breccia. A pyrrhotite-pyrite mineralized zone containing nickel, copper, gold and platinum, occurs in sheared metavolcanics in the Copper-Brunne lakes area.

The Namew Lake nickel-copper deposit, found under Paleozoic rocks, is hosted by a "pipe-like" ultramafic sill. It also contains PGM. In the Phanerozoic-covered Goose Lake area, PGM were found in association with Amisk Group rocks containing pyrrhotite and minor copper, nickel and zinc.

Flin Flon Mine (N.T.S. 63K/13SW; Map B, location no. 24)

The Flin Flon Mine is located in the city of Flin Flon on the provincial boundary between Manitoba and Saskatchewan.

The deposit consists of six lenticular orebodies that occur in folded Amisk volcanics (Coats et al., 1972). The host rock for the massive and disseminated sulphide ore is a rhyolite flow and flow breccia (traditionally called "quartz porphyry"); it is overlain by porphyritic pillowed mafic flows to the east and underlain by mafic flows and breccias to the west (Bailes et al., 1987). An extensive zone of alteration, consisting mainly of chlorite, is associated with the deposit. Mineralization consists of pyrite, pyrrhotite, sphalerite, chalcopyrite, and minor cubanite, galena, tetrahedrite, tennantite, sylvanite, tetradymite, altaite, magnetite, electrum and gold (Gale and Eccles, 1988, p. 11). The deposit had 62 447 000 tonnes (combined production and reserves) of ore averaging 2.2% Cu and 4.1% Zn, for the period 1930 - 1984; gold, silver, selenium, tellurium and cadmium are also recovered from the ore (Fogwill and Bamburak, 1987, p. 28).

It was reported that spectrographic analyses of copper ores from the Flin Flon Mine indicated contents of 0.055 g/tonne palladium and 0.07 g/tonne rhodium in chalcopyrite, and 0.056 g/tonne palladium in pyrrhotite (Hawley and Rimsaite, 1953; see also Mineral Inventory card 63K/13 CU 3; Byers et al.,1965, p. 80).

Copper-Brunne lakes (N.T.S. 63K/11NE; Map B, location no. 25)

Samples from "iron-sulphide bodies" in the Copper and Brunne Lake areas are reported to carry gold, copper, nickel and platinum in traces (Wright, 1931, p. 50; Manitoba Mines and Natural Resources, 1937, p. 72; 1952, p. 107).

Wallace (1920, p. 31) reported: "On the "Depth Charge" at the south end of Copper Lake, quartz bands alternate with pyritized schist in a cross-trench thirty-five feet wide. On the west side of Brunne Lake, on Gordon's claims, and particularly on the Caribou group further south, the

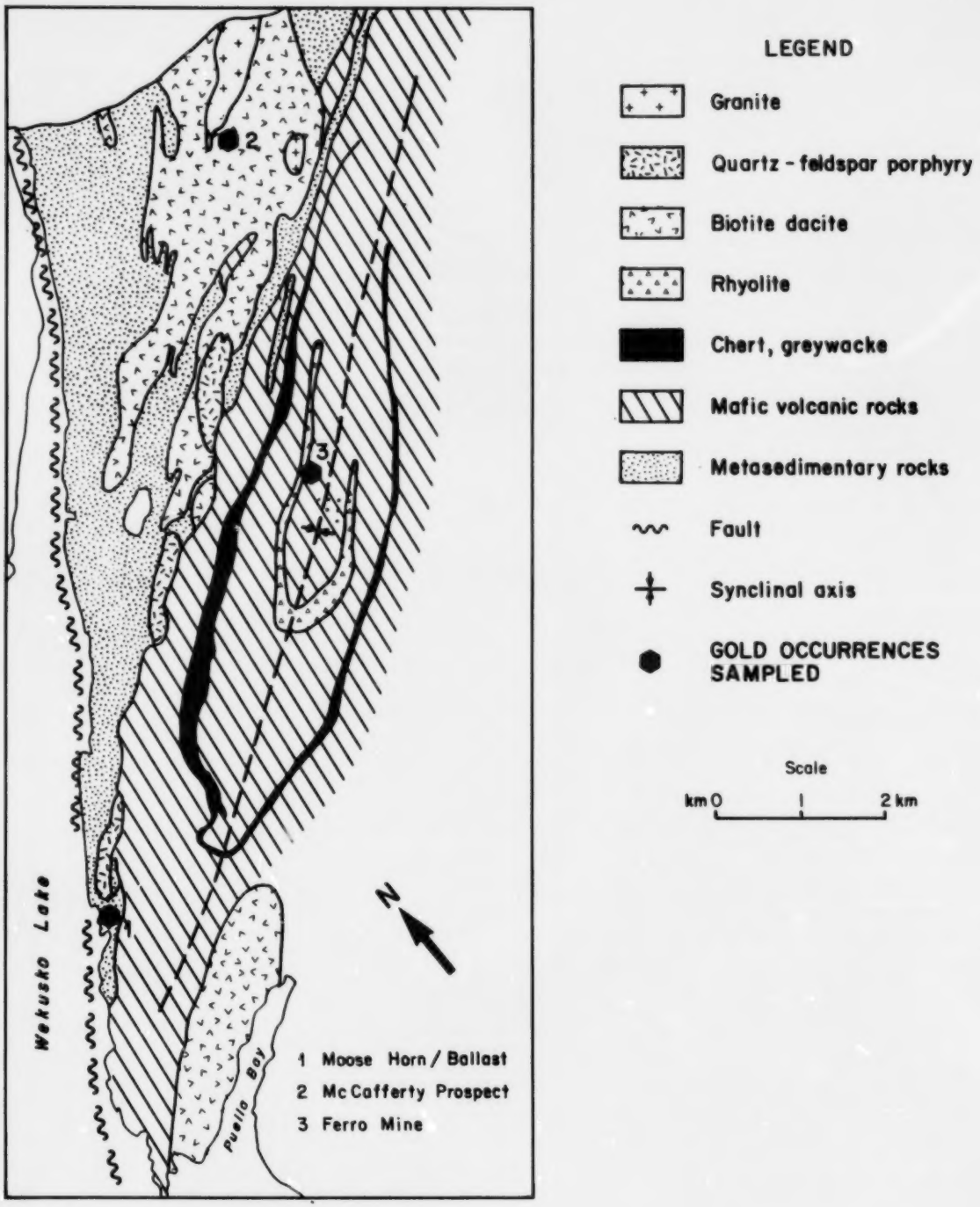

Figure 11: Geological sketch map of the Wekusko Lake area, and location of PGM occurrences (from Theyer, 1988).

same type of mineralization continues. On the Caribou claims the mineralization is unusually heavy. The width of the band is probably seventy-five feet (22.86 m), and on the west side, where some work has been done, the rock is almost solid pyrite and pyrrhotite. Values in gold, copper, nickel and platinum have been obtained but no systematic sampling has been done".

On the Caribou claim (south and southeast of Swamp Lake, north of Brunne Lake), a mineralized zone, 1.22 km long and 0.031 km wide, is reported in a sheared metavolcanic belt. The zone is part of a mineralized zone that is 6.44 km long and 0.061 km wide (Non-confidential Assessment File No. 90292). Several quartz-feldspar porphyry dykes, and small faults also occur in the area. Mineralization consists of massive pyrrhotite, minor pyrite, chalcopyrite, sphalerite, galena and bornite. Blue-black quartz veins containing pyrite, chalcopyrite, gold, and silver have been reported.

Reed Lake (N.T.S. 63K/9, 10?; Map B, location no. 26)

Platinum-group metal mineralization has been reported in several narrow ultramafic units near the base of a layered intrusion in the Reed Lake area (International Platinum Corporation, Annual Report, 1986; Northern Miner, March 30, 1987).

In 1986, staking of 2873 ha over the swamp-covered intrusion was done. Work scheduled for 1988 includes further sampling and prospecting, ground geophysical surveys and an airborne electromagnetic survey (International Platinum Corporation, Annual Report, 1986; Northern Miner, July 4, 1988). The GSC is currently examining the Reed Lake complex for PGM (Scoates, 1988).

Wekusko Lake (N.T.S. 63J/13SW, SE; Map B, location nos. 27, 28, 29)

In the Wekusko Lake area, three gold occurrences (Moose Horn, McCafferty and Ferro properties) are reported to carry platinum (Fig. 11). Histories of these properties, mainly for gold, can be found in Mineral Inventory cards 63J/13 AU 4, AU 13, AU 2, respectively.

On the **Moose Horn** claim (located south of the settlement of Herb Lake, on the east shore of Wekusko Lake), a gold-quartz vein strikes 035°/65° SE in a biotite lamprophyre dyke that intrudes a quartz feldspar porphyry stock (Wright, 1931, p. 78). The vein, as described by Wright (1931), is estimated to vary from 46 m to over 92 m in length, and from 0.40 to 0.76 m in width. Tourmaline needles are abundant in the quartz. Mineralization consists of arsenopyrite, and minor pyrite, chalcopyrite, galena, sphalerite, free gold and petzite. Small amounts of gold and silver were produced from the deposit in 1917, 1918 and 1931 (Mineral Inventory card 63J/13 AU 4).

According to Bruce (1917), "Platinum has also been reported from this vein but tests have failed to show it". A shaft was being sunk on the vein at the time. It was reported in the Canadian Mining Journal (1916) that the property held by the Northern Manitoba Mining and Development Company "carries platinum". The Northern Manitoba Mining and Development Company, a syndicate headed by R. Kerr, held five claims (Lucky, Moose Horn, Ballast, Lucky Fraction, Pendennis) in the area.

The second platinum occurrence was reported from **'McCafferty's prospect'**, located approximately 9.9 km northeast of the Moose Horn claim. The gold-quartz vein on the property is 488 m long and strikes 045°/75-80° SE through dacite and "quartz-eye" granite or porphyry (Stockwell, 1937, pp. 18, 19). Black tourmaline is abundant in the quartz. Mineralization includes arsenopyrite, chalcopyrite, galena, sphalerite, minor pyrite. 1935 drill indicated reserves were reported as 18 142 tonnes grading 6.86 g/tonne Au (Mineral Inventory card 63J/13 AU 13).

According to the Canadian Mining Journal (1916): "A picked sample from McCafferty's vein shows $49 in gold and $17 in platinum". (Platinum prices were $20/oz (1911); $43/oz (1915-1916); $100/oz (1916-1920); $70/oz (1920); P. Theyer, pers comm. 1988).

Samples from the Rex (Mineral Inventory card 63J/13 AU 1) and Elizabeth (Mineral Inventory card 63J/13 AU 7) mines were apparently also being tested for platinum in 1916. Results are not known.

In 1988, limited platinum sampling programs were carried out in the Wekusko Lake area (Moose Horn, McCafferty's Prospect, Rex Mine, Ferro Mine) by the Manitoba Government. Significant PGM contents were reported from samples of the Ferro Mine (Theyer, 1988).

The **Ferro Mine** is located approximately 6.6 km northeast of the Moose Horn (Ballast Mine) claim area. The area contains gold-bearing quartz veins, lenses and stringers up to 1 m in width, which occur within shear zones and tension fractures in andesite flows; the quartz carries biotite, muscovite, carbonate, pyrite, pyrrhotite, chalcopyrite, free gold and traces of arsenopyrite (Stockwell, 1937, pp. 37-39). Reserve figures have varied: 1973 reserve estimates were 36 284 tonnes of ore grading 9.43 g/tonne Au and 4536 tonnes of mine muck grading 8.57 g/tonne Au (Canadian Mines Handbook, 1973-74). Gold and some silver was produced from the deposit in 1932-33, 1962-64 and 1973-74 (Mineral Inventory card 63J/13 AU 2).

Theyer (1988) reported that one of two rock samples (collected from mine muck in the vicinity of the shaft) assayed 110 ppb Pd, less than 10 ppb Pt, and 1400 ppb Au, while one of four samples of rock powder (stored in plastic bags in one of the abandoned buildings) yielded up to 140 ppb Pd, 80 ppb Pt, and 140 ppb Au.

Phanerozoic-Covered Areas

PGM occurrences located in the Goose Lake - Namew Lake area are shown in Figure 12 and summary data are presented in Table 9.

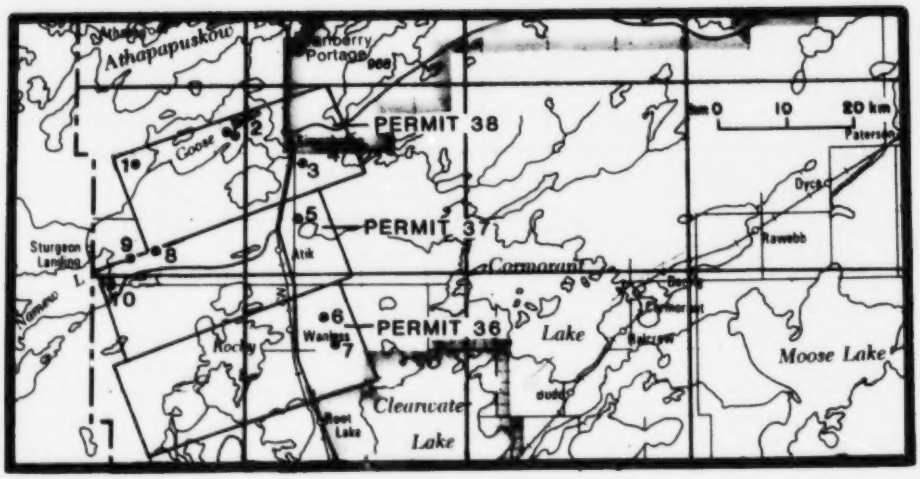

Figure 12: Approximate locations of PGM occurrences in the Goose Lake - Namew Lake area.

TABLE 9

Selected Pt and Pd concentrations reported from various drill holes, Goose Lake - Namew Lake area

Location Number	Drill Hole Number	Anomaly Number	Hole Total Depth(m)	Cu%	Ni%	Zn%	Pt oz/ton	Pd oz/ton	Au	Depth(m)	Length(m)	Reference
1	63508	751	96.3	0.031	0.033	0.390	0.020	0.000	0	73.09	0.10	Cancelled
				0.013	0.009	0.017	0.022	0.000	0	78.83	0.13	Assessment
				0.013	0.007	0.008	0.009	0.000	0	79.03	0.20	File (CAF)
				0.022	0.014	0.023	0.006	0.000	0	79.33	0.30	No. 92473
	63510	751	113.6	0.039	0.036	0.004	0.047	0.000	0	63.45	0.06	(63K/5: PYR 2)
2	63513	387	96.7				minor tr pt (.002)					CAF 92471
	63516	366	152.1				minor tr pt, pd (0.002)					
	63517	410	68.6				minor tr pt (up to 0.003)					
3	63501	169	107.0	0.016	0.029	0.010	0.002	0.000	0	84.24	0.24	CAF 92473
				0.005	0.008	0.008	0.008	0.003	0	84.65	0.11	(90523, 91648)
				0.061	0.043	0.014	0.003	0.000	0	86.13	0.13	
4	63502	33	125.0	0.056	0.027	0.007	0.009	0.004	0	82.30	0.15	CAF 92473 (90529)
5	63503	168	161.0	0.016	0.016	0.020	0.027	0.009	0	122.68	1.13	CAF 92473
				0.042	0.030	0.048	0.013	0.005	0	127.07	0.12	
				0.016	0.011	0.003	0.009	0.004	0	133.34	0.12	
				0.058	0.042	0.212	0.000	0.000	0	133.00	0.84	
				0.040	0.032	0.950	0.000	0.000	0	18.85	0.59	
6	63504	124	154.1	0.008	0.013	0.002	0.002	0.007	0	122.30	0.55	CAF 92473 (90521)
7	63512	144	136.0				(tr. Pt.)					CAF 92473
8	63507	676	168.7	0.022	0.018	0.016	0.008	0.000	0	130.00	0.80	CAF 92473
				0.028	0.028	0.018	0.004	0.000	0	142.12	0.20	
				0.106	0.021	0.008	0.016	0.002	0	155.70	0.25	
9	63506	786	166.5	0.037	0.031	0.006	0.008	0.003	0	116.82	0.02	CAF 92473
?	63524	320	122.3				tr pt, pd (0.002)					CAF 92471
10	Namew Ni-Cu deposit			0.479 g/tonne Pd, 0.651 g/tonne Pt								(Ref. 63K/4 NI1)

NOTE: It is assumed that platinum and palladium concentrations are expressed in oz/ton, although the assessment files (92473, 92471) do not specifically indicate the measurement unit used for these elements.

Goose Lake area (N.T.S. 63K/3,5,6; Map B, location nos. 30-42)

The property is located on the east side of a main logging road, approximately 1.6 km west of the outlet of Goose Lake into Goose River (Figure 12, location no. 1). It has the highest PGM concentration of all the occurrences in the Phanerozoic-covered area. The history of exploration in this area is detailed in Mineral Inventory cards 63K/5 PT 1, PYR 2.

The area is covered by flat-lying Paleozoic limestones and dolomite of the Ordovician Red River Formation which is underlain by a thin layer of Winnipeg Sandstone (Non-confidential Assessment File No. 92471). Paleozoic rocks vary in thickness from 6 to 55 m, and thicken to the southwest. McCabe (1984) notes that despite the regional structural dip to the south, no general thickening of Phanerozoic strata occurs. The Precambrian surface below is "irregular and strongly weathered, leached and altered to a depth of 1.5-30 m; the upper part consists of white to green chloritic mud, grading into leached and crumbly, locally limonitic, granitic rocks" (Non-confidential Assessment File No. 92471). Studies of the sub-Phanerozoic geology in this region, have been carried out by the GSC and the Manitoba Government (Hosain, 1984; McRitchie and Hosain, 1986; Taiga Consultants Ltd., 1986).

Traces of platinum and palladium were reported from thirteen of twenty-three drill holes (totalling 2946 m) that were drilled in various parts of the Paleozoic-covered Goose Lake - Namew Lake area, by Canadian Nickel Company Limited in 1980-1981 (Non-confidential Assessment File Nos. 92471, 92473, 92755).

Two of the holes were drilled to test two medium to strong EM conductors that apparently flank a magnetic anomaly. Drill hole ddh no. 63508 intersected "a sequence of amphibolitic (volcanic) and tuffaceous rocks with gneissic interbeds" (Non-confidential Assessment File No. 92473). 60-70% pyrrhotite was noted in the core. Sections of core with sulphide mineralization assayed up to 0.68 g/tonne (0.02 oz/ton) Pt, platinum in traces from 71.0 m - 79.0 m, as well as 0.39% Zn and 0.155% Zn at 73.0 m and 74.8 m, respectively (see Table 9). Another hole (ddh no. 63510) intersected gneisses and metasediments with graphite, pyrrhotite, up to 60% pyrite in sediments; core from this hole returned traces of platinum in assays, and one assay of 1.61 g/tonne (0.047 oz/ton) Pt. Depth of overburden varies from 40 m to 44 m in these holes.

Namew Lake Mine (N.T.S. 63K/4NW; Map. B, location no. 43)

The Namew Lake deposit is located near the southeastern shore of Namew Lake, 25 km west of the town of Atik, and 64 km south of Flin Flon. It lies 1.6 km east of the Manitoba-Saskatchewan border. The history of exploration and development of the deposit is detailed in Mineral Inventory card 63K/4 NI 1.

The nickel-copper deposit was discovered by Hudson Bay Exploration and Development Company Limited in 1984 by diamond drilling, following airborne and ground geophysical exploration work carried out in 1980-1982. On November 15, 1988, the mine was opened by joint venture (60/40) partners Hudson Bay Mining and Smelting Co., Limited and Outokumpu Mines Limited.

Diluted recoverable reserves between the 61 and 335 m levels are estimated at 2.58 million tonnes with a grade of 2.44% Ni, 0.9% Cu, 0.102 g/tonne Au, 4.11 g/tonne Ag, 0.479 g/tonne Pd, 0.651 g/tonne Pt (Pickell, 1987). When in full production, the mine is expected to produce 476 000 tonnes of ore annually yielding 62 000 tonnes of nickel concentrate with minor amounts of platinum and palladium, and 12 200 tonnes of copper concentrate (Northern Miner, November 23, 1987). The mill is currently operating at about 400 tonnes per day (Northern Miner, January 12, 1989).

The deposit, as described by Pickell (1987), occurs 600 m from the southeastern shore of Namew Lake, under 6 m of water and 40 m of flat-lying Ordovician dolomite and sandstone. It consists of a "pipelike" ultramafic sill that strikes 350°, dips 48° SW and plunges 30° NW above the 335 m level and 45° below the 335 m level. Its "abrupt upward termination" distinguishes it from other similar mafic/ultramafic sills in the area. "The ultramafic body typically has moderately well-foliated, biotized and chloritized margins". Olivines throughout the ultramafic body have undergone a mild (to moderate) serpentinization. The average composition of 26 samples of ultramafic host-rock "lies on the boundary between basaltic and ultramafic komatiites".

The sill occurs near the interface between magnetite-bearing diorite sills and aplitic quartz monzonite gneisses. A metadiorite unit appears to be spatially related to the sill. Aplite-pegmatite veins that cut all country rocks are enriched in chalcopyrite next to the deposit; the veins account for less than 10% of the ultramafic pipe.

The deposit comprises a high grade, 0.3-4.0 m thick layer of a "near solid sulphide-cemented, aplite breccia ore" consisting of violarite, chalcopyrite, pyrite/marcasite and minor amounts of partially violaritized pentlandite, which forms a conductive halo around the top 170 m of the ultramafic pipe; a lower grade, 3-30 m thick zone of a disseminated-sulphide (pyrrhotite, pentlandite, pyrite and chalcopyrite), ultramafic-hosted, ore that accounts for 87% of the drill indicated tonnages above the 335 m level; and a relatively sulphide-poor zone below the 335 m level. Preliminary sulphur isotope analyses suggests that the sulphur is mantle-derived. The ore contains less than 5% finely disseminated magnetite that seems to increase in the basal sections. Also identified, was a grain of michenerite (PdBiTe) as an inclusion in pyrrhotite.

The Pas (N.T.S. 63F/14; Map B, location no. 44)

A vague reference to platinum in The Pas was made by Kitto (1923, p. 18): "values of platinum have been obtained at the Caribou claims, on the west side of Brunne Lake, north of Cranberry Lake in Northern Manitoba; at and near the town of The Pas, all in northern Manitoba; and at Star Lake in the Boundary district".

However, this reference was not included in a later publication by Kitto (1925, p. 44).

Other:

The GSC is currently examining selected mafic-ultramafic intrusions in the Flin Flon-Snow Lake greenstone belt for PGM (Scoates, 1987b).

Platinum exploration projects by several private companies (Arctic Gold & Platinum Inc., Platinum Resources of Canada, Manitoba Platinum Resources, Park Place Platinum, Manitex Minerals Inc.) have been reported in the Athapapuskow Lake and Goose Lake areas (Northern Miner, June 15, 1987; January 30, 1989).

Other areas that have been noted as potential PGM exploration targets include: the area southwest of Mink Narrows in Athapapuskow Lake and northeast of the town of Athapap, (N.T.S. 63K/12SE), (Syme, 1987, pp. 36, 38); the Tartan Lake area (N.T.S. 63K/13SE) located 13.5 km northeast of Flin Flon (Theyer, pers. comm., 1987); and the Farewell Lake (N.T.S. 63K/9SE) and Leak Lake (N.T.S. 63K/10SW) areas (Taiga Consultants Ltd., 1986).

Other Explored Areas

The GSC is examining selected intrusions in the Lynn Lake-Rusty Lake greenstone belts and Kisseynew gneiss belt, for PGM; some mafic-ultramafic intrusions that indicate the presence of crustal contamination, appear to contain low PGM (Hulbert, 1987).

The Seal River area, located in the northeast part of the Churchill Province, is reported to have good potential for platinum placers (Theyer, pers. comm., 1987).

PLATINUM-GROUP METALS IN THE CHURCHILL-SUPERIOR BOUNDARY ZONE

The Churchill-Superior boundary zone consists of three segments: the Fox River volcanic belt, the Split Lake block and the Thompson Nickel Belt. The zone can be traced eastward (Fox River belt extension) and southward (Thompson Nickel Belt extension) under Phanerozoic rocks (Manitoba Energy and Mines, 1980).

Most of Manitoba's PGM production is from the Thompson Nickel Belt. The southern part of the Thompson Nickel Belt is considered to have good potential for PGM mineralization (Theyer, pers. comm., 1987). PGM were found in the Fox River belt.

Fox River Greenstone Belt

The Fox River greenstone belt is a 300 km long, east-west trending sequence of sedimentary rocks and mafic to ultramafic flows and sills, which form a homoclinal belt dipping steeply to the north (Fig.13). PGM mineralization in the belt is associated with a layered mafic to ultramafic intrusion known as the Fox River Sill.

Fox River Sill area (N.T.S. 53N/10-15; 53M/16; Figure 13, location nos. 1 & 2)

The area is located south of the Fox River, east of the Stupart River, 68 km west and 10 km south of the town of Shamattawa. It covers 1078 km^2.

Permits 68 and 69 cover 20 km of the west lobe and 60 km of the east lobe of the Fox River Sill. The east lobe and the west lobe are two major segments of the Fox River Sill, each approximately 70 km long, separated by a 12 km gap (Scoates, 1981).

The Fox River Sill is a stratiform, ultramafic to mafic Proterozoic intrusion that is 250 km long and up to 2 km thick (Heaman et al., 1986; Scoates, 1981). It consists mainly of dunite, gabbro, peridotite and pyroxenite (Scoates, 1981) and is predominantly ultramafic in composition with more than 75% consisting of olivine cumulates (Scoates and Eckstrand, 1986).

It is hosted in the middle sedimentary formation where it intrudes a siltstone-sandstone sequence, and is subdivided into 4 lithostructural zones (Fig.14): the hybrid roof zone consisting of a mix of gabbro, pegmatite, and sedimentary xenoliths; the upper central layered zone (UCLZ) with repetitive cyclic units (based on cumulus olivine content) of lherzolite, websterite, and gabbronorite; the lower central layered zone (LCLZ) with repetitive cyclic units of wehrlite, dunite, and olivine clinopyroxenite; and the marginal zone consisting of repetitive cyclic units of lherzolite, websterite and gabbronorite (Scoates, 1981, pp. 97-99). The number of layers and cyclic units are variable. A recent study identified as many as 40 layers and 19 cyclic units in the UCLZ, and 18 layers and 10 cyclic units in the LCLZ. The UCLZ is a more thinly interlayered zone than the LCLZ (Scoates and Eckstrand, 1986).

Drill core from two holes (ddh nos. 13231 and 38524) drilled in the western intrusion (Fig. 13: location no. 1) were examined by the Geological Survey of Canada (Scoates and Eckstrand, 1986). Twelve samples (ranging from 20 g to 100 g) were selected on the basis of having the most visible sulphides, and were analyzed for platinum-group elements (platinum, palladium, osmium, rhodium, ruthenium and iridium) using a fire assay, neutron activation technique. Results of the analysis (Table 10) indicate:

i) PGE abundances of up to 1200 ppb associated with sulphides in the UCLZ: the sulphides (mainly pyrrhotite and pentlandite) in this zone occur as sparsely disseminated blebs or sometimes as fine replacements of other minerals. Sulphides constitute less than 1% by volume of the sill.

ii) Rhodium, platinum and palladium anomalies associated with thin cyclic units that are less fosterite-rich (Fo_{82-84}).

iii) A statistical correlation between Ir, Rh, Pt, Pd, and to a lesser degree Au; a "lack of correlation of Ru with the other platinum-group elements". (Scoates and Eckstrand, 1986).

According to Scoates (1987c), "Anomalous platinum-group element (PGE) concentrations (greater than 100 ppb combined Pt + Pd + Au)" hosted by sulphide-bearing olivine clinopyroxenites (clinopyroxene ± olivine cumulates), occur sporadically throughout the stratigraphic succession. Schwann and Scoates (1988) identified three PGE mineralized intervals ranging from 9 to 80 m in thickness and found a moderately positive correlation between PGE and base metal sulphides. Associated minerals or products of value in the Fox River Sill include nickel and chromite (Report of the Task Force, 1974, pp. 49, 52-53), and copper (Northern Miner, April 21, 1986).

The history of exploration work in the Permit 68 and 69 areas, is documented in Mineral Inventory card 53N/11 PT 1. Scoates and Eckstrand (1985) first reported that the Fox River Sill had potential for PGM mineralization. Detailed studies of the cumulus minerals of the Fox River Sill were carried out at the University of Manitoba, with financial support from the GSC, in 1983-1986 (Turnock et al., 1986).

A joint venture agreement was signed between Silver Lake Resources Inc. (later renamed, International Platinum Corporation) and BP Canada Inc. to explore for PGM in Manitoba; BP had the right to earn a 60% interest in Silver Lake's Manitoba platinum property by spending $1 million on exploration (Northern Miner, January 27, 1986). On January 28, 1986, parts of the Fox River Sill were staked by BP Resources Canada Limited-Selco division under Permits 68, 69 (Fig.13: location no. 2). The area had been targetted for its PGM potential by Frank Guardia and James Atkinson (Tintor, 1986). Exploration work conducted on the property included a five hole, 1524 m diamond drilling program and a 4184 km airborne survey that was flown over the eastern 70% portion of the intrusion (Manitoba Mines Branch, Corporation File, International Platinum Corporation).

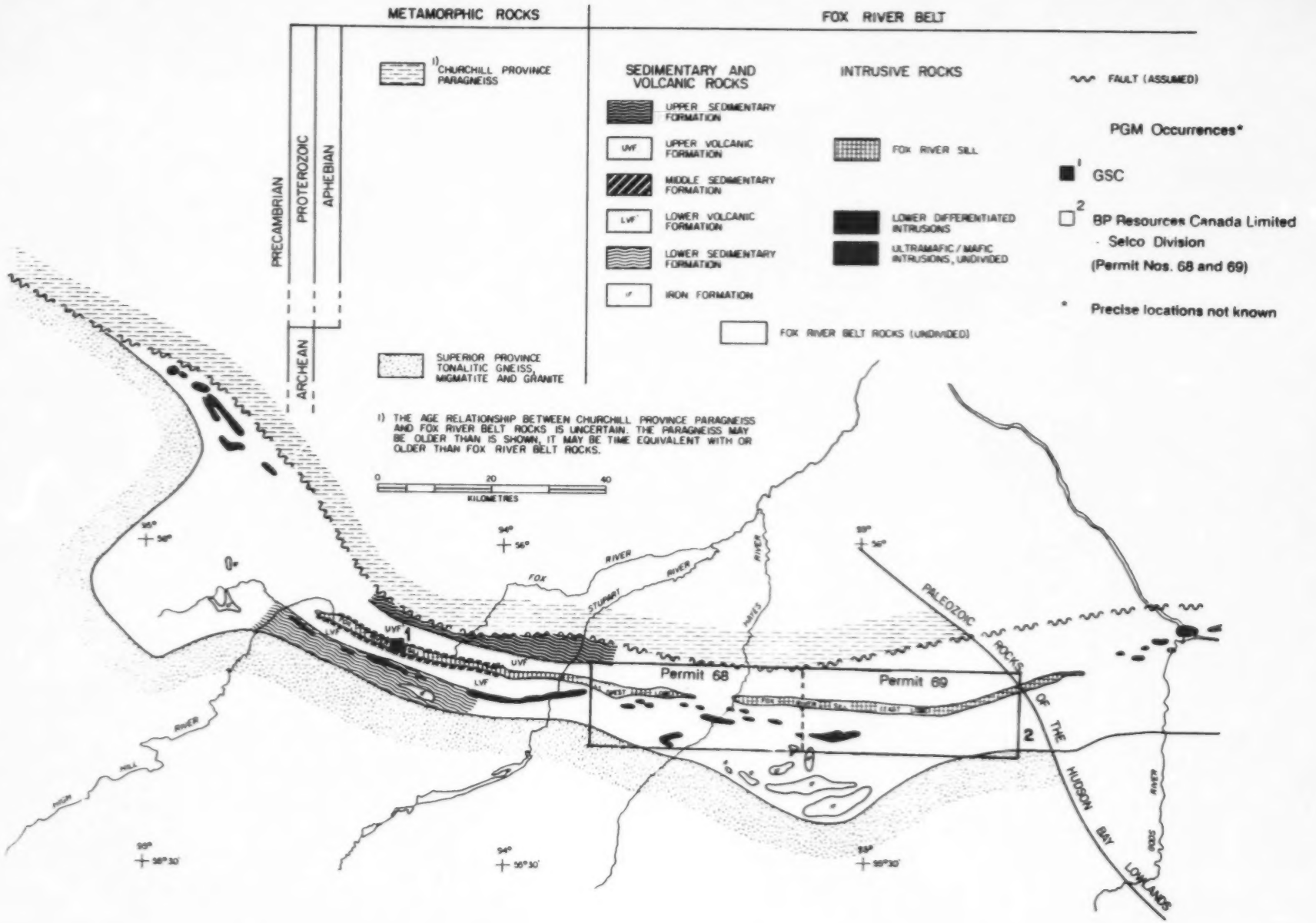
METAMORPHIC ROCKS
FOX RIVER BELT
PRECAMBRIAN
PROTEROZOIC
APHEBIAN
ARCHEAN
1) CHURCHILL PROVINCE PARAGNEISS
SUPERIOR PROVINCE TONALITIC GNEISS, MIGMATITE AND GRANITE
SEDIMENTARY AND VOLCANIC ROCKS
UPPER SEDIMENTARY FORMATION
UVF UPPER VOLCANIC FORMATION
MIDDLE SEDIMENTARY FORMATION
LVF LOWER VOLCANIC FORMATION
LOWER SEDIMENTARY FORMATION
IF IRON FORMATION
INTRUSIVE ROCKS
FOX RIVER SILL
LOWER DIFFERENTIATED INTRUSIONS
ULTRAMAFIC / MAFIC INTRUSIONS, UNDIVIDED
FOX RIVER BELT ROCKS (UNDIVIDED)
FAULT (ASSUMED)
PGM Occurrences*
1 GSC
2 BP Resources Canada Limited - Selco Division (Permit Nos. 68 and 69)
* Precise locations not known
1) THE AGE RELATIONSHIP BETWEEN CHURCHILL PROVINCE PARAGNEISS AND FOX RIVER BELT ROCKS IS UNCERTAIN. THE PARAGNEISS MAY BE OLDER THAN IS SHOWN, IT MAY BE TIME EQUIVALENT WITH OR OLDER THAN FOX RIVER BELT ROCKS.
0 20 40
KILOMETRES
Permit 68
Permit 69
PALEOZOIC ROCKS OF THE HUDSON BAY LOWLANDS
FOX RIVER
STUPART RIVER
HAYES RIVER
PIVOP HILL RIVER
94° 56°
94° 56°30'

Figure 13: General geology of the Fox River belt (from Scoates, 1981), and location of Permit Nos. 68 and 69.

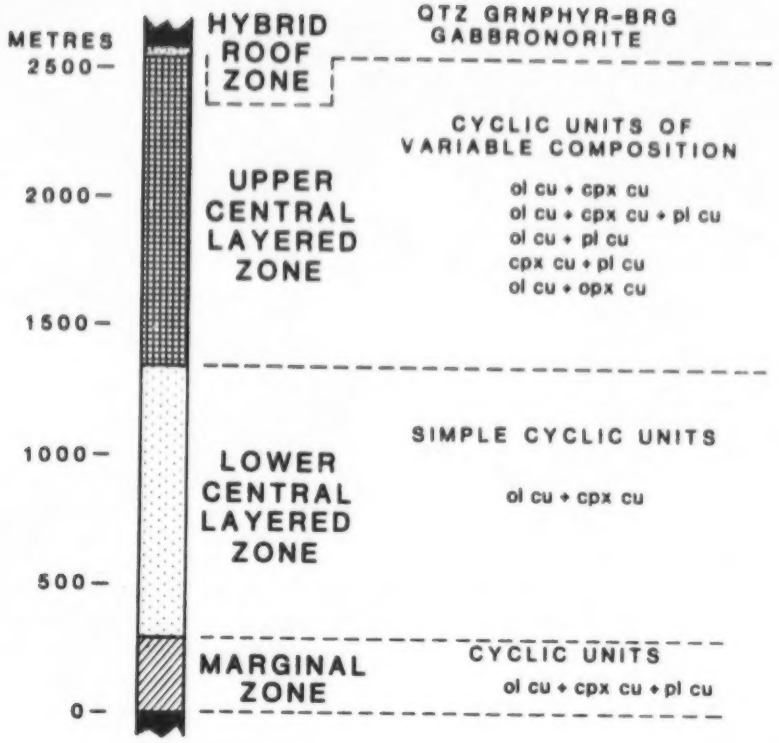

Figure 14: Composite stratigraphic section with the main sub-divisions of the Fox River Sill (from Scoates and Eckstrand, 1986).

TABLE 10
Platinum-group element analyses of sulphide-bearing rocks of the Fox River Sill (in ppb) (from, Scoates and Eckstrand, 1986).

	1	2	3	4	5	6	7	8	9	10	11	12	Detection limits
Ru	< 5	20	23	16	12	10	< 5	13	10	< 5	< 5	21	5
Rh	33	10	9	3	2	18	10	3	3	2	2	4	1
Pd	810	200	230	47	26	430	180	39	32	13	< 5	33	5
Pt	350	220	190	23	26	190	110	18	26	21	< 5	46	5
Os	< 3	3	3	< 3	3	< 3	< 3	< 3	< 3	< 3	< 3	4	3
Ir	5.4	4.3	3.6	1.1	1.6	3.0	1.9	1.3	1.2	0.7	1.4	2.7	0.1
Au	24	8	23	14	4	140	15	9	14	4	8	10	1
Pd/Ir	150	47	64	43	16	143	95	30	27	19	-	12	
(Pt + Pd) / (Os + Ir + Ru)	>87	15	14	3.4 to 4.1	3.1	39 to 48	>29	3.3 to 4.0	4.1 to 5.2	-	-	2.9	
Sulfides*	14.1 (4.7)	7.7 (5.4)		3.6 (1.8)	11.4 (3.9)	9.9 (6.0)		10.3 (7.7)		5.7 (4.6)	8.3 (10.4)	18.3 (14.2)	
Chromite*	0	0.03 (0.11)		0	0	0.05 (0.10)		0.6 (1.0)		0.4 (0.3)	0.6 (0.7)	0	
Magnetite*	17 (2.1)	0.8 (2.9)		0	0	0.2 (0.5)		0		0	0	0.7 (1.2)	

Analyses by Nuclear Activation Services Limited, Hamilton, Ontario
- Platinum-group element levels too low to calculate meaningful values
* Volume percent by image analysis (Cambridge Instruments Quantimet 920); average of four to seven fields (50x magnification); one standard deviation in parentheses

By April 1986, four holes had been drilled: Hole 1 cut a 42.1 m layered sequence containing 0.34 - 0.69 g/tonne Pt and Pd; Hole 2 cut a 6.1 m section grading 0.69 - 1.03 g/tonne Pt and Pd; Hole 5 (in progress) cut copper-bearing sulphides; at least three additional parallel platinum-bearing zones were inferred based on magnetic interpretation (Northern Miner, April 21, 1986).

Results of the 1986 drilling (Table 11) point to 3 platinum-bearing zones and two other potential zones in the layered mafic intrusion (Northern Miner, July 7, 14, 1986); four distinct horizons with high quantities of PGM were indicated by the 1986 drilling (Northern Miner, February 16, 1987). Three areas were targetted for drilling in 1987.

TABLE 11
Results of the 1986 drilling program in the Fox River Sill area, by BP Resources Canada Limited-Selco Division

(from Northern Miner, July 7, 14, 1986)

Hole No.	Platinum/Palladium		Width
1	0.24 g/tonne	(0.007 oz/ton)	9.2 m
2	0.27 g/tonne	(0.008 oz/ton)	18.9 m
5	1.03 g/tonne	(0.03 oz/ton)	1.01 m

In June 1987, International Platinum Corporation and Degussa AG, formed a 50:50 joint venture to explore for platinum-group metals in North America with an exploration budget of $4.5 million (Johnson Matthey Public Limited Company, 1987). In 1988, five platinum-bearing zones were intersected in 15 drill holes. A 3658 m drill program in the central and western parts of the claims was scheduled for August, 1988 (Northern Miner, July 4, 1988).

Thompson Nickel Belt

Nickel deposits of the Thompson Nickel Belt are associated with ultramafic and metasedimentary rocks of the Ospwagan Group and supracrustal rocks that may be part of the felsic gneisses (Gale et al., 1982). The deposits occur in an area 136.7 km long and 24.1 km wide (Zurbrigg, 1963).

About eleven nickel-copper deposits in the belt are reported to contain platinum-group metals. The deposits, with the exception of Falconbridge Limited's Manibridge deposit, are held by Inco Limited. Both Inco and Falconbridge have produced PGM as by-products from Manitoba nickel ores.

Manibridge Mine (N.T.S. 63J/10NW; Map C, location no. 46)

The Manibridge Mine of Falconbridge Limited (formerly, Falconbridge Nickel Mines Limited) is located 4 km east of Provincial Road No. 391 and 32 km southwest of Wabowden.

The mineralized zone is about 450 m long and contains several lens-shaped orebodies with 1 to more than 3% nickel (Phillips, 1979). Mineralization occurs as disseminated, net-textured and semi-massive sulphides (pyrrhotite, pentlandite, pyrite, chalcopyrite, violarite) in an ultramafic body composed of serpentinized peridotite and minor amounts of amphibole bearing olivine pyroxenite, intrusive

into gneissic country rock; magnetite veins crosscut the sulphides (Coats and Brummer, 1971).

The serpentinite occurs over a 1.5 km length and up to a 900 m width (Phillips, 1979). It strikes 030°, dips 70° SE, and is underlain by a 15 m thick mylonite zone. Ultramafic rock adjacent to pegmatite dykes (up to 15.2 m wide, and containing up to 5% sulphides that are associated with biotite in places) are altered to anthophyllite, phlogopite, chlorite, carbonate and talc (Coats and Brummer, 1971).

The nickel-copper deposit was discovered in the early 1960's by airborne survey-work and diamond drilling (Mineral Inventory card 63J/10 NI 1). "The deposit was mined from 1971 until April, 1977 during which time 937 912 tonnes of ore with an average grade of 1.8% Ni and 0.14% Cu were produced" (Theyer, 1980). Falconbridge Nickel Mines Limited recovered an estimated 50 090 g (1900 oz) of PGM by-products from its Manitoba ores during the period 1971 - 1972 (Table 12).

TABLE 12
PGM production by Falconbridge Limited; 1971-1972
(from Report of the Task Force, 1974)

1971	18 662 g*	(600 oz)
1972	40 434 g*	(1 300 oz)

*Estimated using a Pt/Ni ratio of 0.0002.

In 1975, Falconbridge analyzed samples from the Manibridge deposit for PGM content using a fire assay (lead) and emission spectrographic method. Analytical results reported by Naldrett and Cabri (1976) are shown in Table 13. The concentration of the original sulphide liquid of the Manibridge deposit is roughly estimated (theoretically by R.C. Stavely) at: 10.0 wt% Ni, 0.75 wt% Cu, 0.26 ppm Rh, 2.6 ppm Pd, 0.95 ppm Pt, 0.24 ppm Au (Naldrett and Cabri, 1976).

Pipe Mines (Pipe 1 and Pipe 2) (N.T.S. 63O/8NE; Map C, location nos. 49 and 50)

The property is located 2.5 to 5 km west of Provincial Road No. 391, and approximately 32 km southwest of the city of Thompson. The two mines are about 1.5 km apart.

Disseminated and stringer sulphides (pyrrhotite, pentlandite, and pyrite) occur in serpentinized peridotite on the west limb of a deformed fold (Coats et al., 1972). The ore zone is a highly jointed and fractured serpentinite body approximately 152 m wide and 671 m long, enclosed by metasediments consisting of micaceous quartzites, iron-rich amphibolites and skarns (Janeson, 1979). Accessory minerals include magnetite, chromite, mackinawite, violarite, chalcopyrite and cubanite, with smaller amounts of gersdorffite, niccolite, maucherite, sphalerite, goethite, rutile and graphite (Phillips, 1979).

The Pipe 1 deposit was mined from 1970 to mid-1971. The Pipe 2 Open Pit was in production from 1970 to 1984; the average grade of the ore is just less than 1% Ni (Mineral Inventory card 63O/8 NI 3). Nickel, copper, platinum, palladium, gold and silver have been produced from the Pipe deposits (Fogwill and Bamburak, 1987).

The **Pipe** deposit, which is associated with ultramafic possibly komatiitic rocks, was studied by Naldrett et al.(1979), Naldrett (1981, pp. 218-219, 222, 224) and Cabri and Laflamme (1981, pp. 155, 161, 163-164, 168). Twenty-six samples, generally 1-2 kg in size, were analyzed for platinum-group elements and gold using a fire-assay and neutron-activation method: values (recalculated to metal content in 100% sulphides) of 3.96 wt % Ni, 0.16 wt % Cu, 0.16 wt % Co, 54 ppb Pt, 122 ppb Pd, 35 ppb Rh, 217 ppb Ru, 55 ppb Ir, 107 ppb Os, 57 ppb Au, were reported (Naldrett et al., 1979). Results of microprobe analyses of PGM from the **Pipe** deposit are shown in Table 14. **Pipe** nickel-copper ore was reported to contain inclusions of irarsite (Cabri, 1981a, p. 110).

A sample of a sulphide vein cutting serpentinite taken from the Pipe 2 Mine, was analyzed by CANMET. The sample was reported to contain pentlandite (partly altered to violarite), pyrite, pyrrhotite, magnetite, with minor to rare maucherite, cubanite, galena, chalcopyrite, graphite, Bi-tellurides, marcasite, chromite, arsenopyrite, melonite, niccolite, hessite, cobaltite, and minute inclusions of sperrylite ($PtAs_2$), michenerite (PdBiTe), froodite ($PdBi_2$), and irarsite (IrAsS) (Cabri, 1981b, p. 242).

Samples of ore from the Pipe 2 Mine were selected from GSC collections for PGM analyses, by lead fire-assay, and by carbon-rod atomic absorption spectrometric methods (Jonasson et al., 1987). Results, representing heavy mineral concentrates, are shown in Table 15.

The **Pipe 1** deposit is reported to have a Pt/Pd ratio of 0.48 (based on weight percent); the **Pipe 2** deposit a ratio of 1.46 (Peredery et al., 1982, p. 180).

Soab South Mine (N.T.S. 63O/1NW; Map C, location no. 47)

The mine is about 1 km west of Provincial Road No. 391 and 68 km southwest of the city of Thompson.

The nickel-copper deposit was found in the early 1950's by aeromagnetic surveys, ground electomagnetic surveys and diamond drilling. The Soab South deposit was mined from 1967 to 1971. In 1968, the Soab deposit, which includes both the Soab South and Soab North deposits, was estimated to contain 90 744 - 907 441 tonnes of ore grading up to 1.5% Ni (Mineral Inventory card 63O/1 NI 1).

The orebody is irregular in shape; relatively massive sulphides occur in metasediments, gneisses and serpentinized peridotite (Phillips, 1979). Mineralization consists of pyrrhotite, pyrite, pentlandite, and chalcopyrite. A Pt/Pd ratio of 0.87 (based on weight percent) has been reported for the deposit (Peredery et al., 1982).

Soab North Mine (N.T.S. 63O/1NW; Map C, location no. 48)

The mine is located 200 m west of Provincial Road No. 391 and about 3 km northeast of the Soab South Mine.

Table 13
PGE concentrations in Ni-Cu ores from the Manibridge Mine (from, A.R. Graham (Falconbridge Nickel Mines Limited), 1975 in Naldrett and Cabri, 1976)

		concentration									
		ppb				wt%					
No. of Samples	Type of Samples	Rh	Pd	Pt	Au	Ni	Cu	Cu / Cu+Ni	Pd / Pd+Rh	Pt / Pt+Pd	Au / Au+Pt+Pd
1	Ore sample	170	994	300					0.85	0.23	
2	Concentrate with Ni grade adjusted to 2%	52	520	190	47	2.0	0.15	0.07	0.91	0.27	0.06

Table 14
Microprobe analyses of platinum-group metals and cobaltite from the Pipe deposit
(from, Cabri and Laflamme, 1981)

	Ir	Ru	Rh	Pt	Pd	Os	Ni	Co	Fe	As	S	Bi	Te	Sb	Totals
Irarsite	49.5	n.d.	2.2	6.1	0.21	n.d.	3.0	1.1	0.57	29.3	9.3				101.28
Sperrylite	1.8	n.d.	n.d.	54.4	n.d.	n.d.	0.14	n.d.	0.08	42.2	0.16			1.1	99.88
range	0.16-6.0		n.d.-0.20	(52.3-56.9)	(0.03)		0.14-0.61		0.07-0.47	41.2-42.5	(0.07-0.60)			0.75-1.3	
Cobaltite	0.19	-	7.2	0.20	n.d.	-	9.3	17.0	5.1	43.1	18.1		-	-	100.09
Froodite				n.d.	20.3							80.0	0.16	0.10	100.56
Michenerite				n.d.	23.8		0.36		0.07			46.4	28.3	1.4	100.33
range					(20.4-24.2)		(0.34-2.6)		(0.07-0.27)			(43.3-46.4)	(28.3-31.6)	(1.1-1.9)	

Table 15
Preliminary results of analyses of Cu-Ni ores from the Pipe No. 2 Mine
(from Jonasson et al., 1987)

	Pt ppb	Pd ppb	Au ppb	Pt / Pt+Pd	Sample Number
	0	15	20	0	388
	25	75	20	0.250	389
	5	150	30	0.032	396
	35	85	10	0.292	327A
	5	140	5	0.034	327B
Mean Values	14	93	17	0.131	
Detection Limits	5	5	5		

The deposit was found in 1953 by diamond drilling, following airborne and ground geophysical exploration work. The deposit was mined from 1967 to 1971 (Mineral Inventory card 63O/1 NI 2).

Massive to disseminated sulphides occur in Precambrian serpentinized peridotite, and also in schist and pegmatite (Coats et al., 1972). Pyrrhotite, pyrite, pentlandite, and chalcopyrite are found in three horizons in an egg-shaped body (Phillips, 1979).

A Pt/Pd ratio of 0.86 (based on weight percent) was reported for the deposit (Peredery et al., 1982). Ore deposit samples were selected from GSC collections for PGM analyses, by lead fire-assay, and by carbon-rod atomic absorption spectrometric methods. Results, representing heavy mineral concentrates, are shown in Table 16.

Table 16
Preliminary results of analyses of Cu-Ni ores from the Soab North Mine
(from Jonasson et al., 1987)

	Pt ppb	Pd ppb	Au ppb	Pt / Pt+Pd	Sample Number
	1820	2060	125	0469	407
	-	-	425	-	411
	0	425	20	0	413
	20	1315	120	0.015	408A
	890	1340	110	0.399	409A
	30	2880	550	0.010	409C
Mean Values	552	1604	225	0.256	
Detection Limits	5	5	5		

- indicates no data

Birchtree Mine (N.T.S. 63P/12NW; Map C, location no. 52)

The mine is located 4 km east of Birchtree Lake and about 5 km southwest of the city of Thompson.

The Birchtree deposit was mined by Inco Limited from 1969 to 1977 during which time more than 136 million kg of nickel were produced. In November 1988, Inco Limited announced plans to reactivate the mine, which has reserves of 318 000 tonnes containing 261 million kg of nickel; production is to resume in 1989 (Northern Miner, November 7, 1988; Prospectors and Developers 1988 Exploration Highlights; Thompson Citizen, November 2, 1988).

"Sulphides occur in massive to stringer form, and as flow breccia, in Precambrian peridotite and biotite schist. The ore is fine- to coarse-grained pentlandite, with minor chalcopyrite, nickel arsenides and other nickel-bearing minerals. The tabular deposit is 1463 m long, 1219 m wide, and 3 m thick (true dimensions). It strikes north to northeast, dips steeply west, and plunges north at 80°. It is stratigraphically controlled near the contacts with metasediments and schists" (INCO Exploration Staff, Thompson, September 23, 1975 in Mineral Inventory card 63P/12 NI 1). Nickel grades of 2-2.8% have been reported for the ores. Accessory minerals include magnetite, chromite, ilmenite, marcasite, sphalerite, and rare galena and tellurobismuthite (Phillips, 1979, p. 36). The deposit also produced copper, cobalt, platinum, palladium, gold and silver (Fogwill and Bamburak, 1987).

Samples of niccolite, maucherite, and gersdorffite from the deposit were analyzed for PGM's by electron microprobe; results were not successful although palladium (0.05 and 0.09 wt%) and rhodium (0.18 and 0.35 wt%) were identified in a grain of one mineral sample (Grice, 1976, p. 114). A Pt/Pd ratio of 0.81 (based on weight percent) was reported for the deposit (Peredery et al., 1982).

Samples of ore from the deposit were selected from GSC collections for PGM analyses, by lead fire-assay, and by carbon-rod atomic absorption spectrometric methods. Results, representing heavy mineral concentrates, are shown in Table 17.

Table 17
Preliminary results of analyses of Cu-Ni ores from the Birchtree Mine
(from Jonasson et al., 1987)

	Pt ppb	Pd ppb	Au ppb	Pt / Pt+Pd	Sample Number
	35	120	30	0.226	376
	5	20	10	0.200	377
	*2100	*14000	*1765	0.130	382
	0	500	20	0	383
	-	-	-	-	384
Mean Values	13	213	20	0.058	
Detection Limits	5	5	5		

*not included in averages
- indicates no data

Thompson Mine (N.T.S. 63P/12NW; Map C, location no. 53)

The mine is located approximately 2 km east of Provincial Road No. 391 and 1.6 km southeast of the city of Thompson.

The deposit was discovered in 1956 following ground geophysical surveys and diamond drilling. In 1960, it was estimated to contain 22.7 million tonnes of ore averaging 2.97% Ni (Fogwill and Bamburak, 1987). The orebody has been mined from two shafts (T-1, T-3) since 1960 and from an open pit in 1985-1986. Another deposit (I-C orebody near the T-3 shaft) and open pit (Open Pit South) are scheduled for full production by 1990 (Thompson Citizen, April 20, 1988).

Theyer (1980, p. 30) reports: "The ore zone of this deposit is a highly deformed sulphide layer within a sedimentary sequence ("Thompson group") that stretches over 12 km in a northeasterly direction and is up to 2 km wide. The sulphide ore is confined to the pelitic portion of the "Thompson group" that also includes siliceous, calcareous, and ferruginous rocks. The metasediments are folded into a steeply plunging anticlinal structure surrounded by gneiss....Ultramafic rocks are restricted to small lenses and blocks adjacent to, or within the sulphide zone". "Disseminated nickel

sulphides commonly occurs in the ultramafic rocks and constitute part of the ore." (Gale et al., 1982).

Sulphide mineralogy consists mainly of pyrrhotite, pentlandite, and chalcopyrite with minor pyrite, violarite, mackinawite, and traces of nickel arsenides including niccolite, gersdorffite and maucherite (Gale et al., 1982, p. 24); minor sphalerite and magnetite are also reported to occur (Phillips, 1979). Nickel, copper, cobalt, gold, silver, selenium, and sulphur have been extracted from the ores (Mineral Inventory card 63P/12 NI 2).

A Pt/Pd ratio of 0.49 (based on weight percent) was reported for the deposit (Peredery et al., 1982). Palladium, minor platinum and platinum elements, have been recovered as by-products of the nickel-refining process. Inco's total PGM production figures for Manitoba as a whole, have been published as follows (Report of the Task Force, 1974; Manitoba Energy and Mines, Annual Reports 1983/84 - 1987/88):

Table 18
PGM production by Inco Limited

Year	Estimated PGM Production		Value ($ 000)
1970	902 kg*	(29 000 oz)	-
1971	843 kg*	(27 100 oz)	-
1972	697 kg*	(22 400 oz)	-
1983	965 kg	(31 000 oz)	8 880
1984	862 kg	(28 000 oz	8 473
1985	666 kg	(21 000 oz	6 886
1986	881 kg**	(28 000 oz)	9 873
1986	-	-	13 235
1987	-	-	17 780

*Based on a Pt content of 0.86 g/tonne and a 50% recovery; Pt/Ni: 0.0004 for 1970, 0.0002 for 1971-1972.
**Estimated.

Samples of ore from the Thompson No. 1 Mine were selected from GSC collections, for PGM analyses (by lead fire-assay, and by carbon-rod atomic absorption spectrometric methods): results (representing heavy mineral concentrates) indicated contents of 200 ppb Pd and 15 ppb Au in one sample, and 805 ppb Pd and 15 ppb Au in another sample (Jonasson et al., 1987).

Mystery Lake South (N.T.S. 63P/13SW; Map C, location no. 54)

A nickel deposit is located beneath Mystery Lake. Most work has been done in the southwestern part of the lake about 300 m east of the road to Moak Lake and 6 km north-northeast of the city of Thompson.

The area was first staked in 1927. Surface drilling was carried out in 1928, 1950, 1952 and 1957, and a large low-grade nickel-bearing body was outlined beneath the lake. Reserve estimates (to a 305 m depth) have varied from 313 million tonnes averaging 0.46% Ni in 1955 to 45.4 million tonnes averaging 0.5% Ni in 1975 (Mineral Inventory card 63P/13 NI 2).

Pyrite, pyrrhotite, pentlandite, chalcopyrite and sphalerite occur as disseminations in Precambrian serpentinized peridotite (Gill, 1951). "The main body is 1432 m long and about 366 m wide though it is only exposed over an area 107 m by 21 m.....The sulphides occur between altered olivine grains; and magnetite is disseminated through the sulphides and the gangue..." (Cove Uranium Mines Limited; Prospectus of May 31, 1955). A Pt/Pd ratio of 1.27 (based on weight percent) has been reported for the deposit (Peredery et al., 1982).

Mystery Lake North (N.T.S. 63P/13NE; Map C, location no. 55)

The nickel deposit is located under the northern part of Mystery Lake about 800 m west of the junction of the main lake and its northeast arm. The city of Thompson is approximately 18 km southwest.

The deposit consists of disseminated sulphides (pyrrhotite, pentlandite, chalcopyrite, pyrite and sphalerite) in Precambrian peridotite (Mineral Inventory card 63P/13 NI 3). It has been traced for 244 m and over a 76.2 m width (Cole, 1953). Drill core assays have ranged from 0.3 - 2.19% Ni and 0.02 - 0.57% Cu; other sources report consistently low (0.3%) nickel contents (Mineral Inventory card 63P/13 NI 3). A Pt/Pd ratio of 0.28 (based on weight percent) has been reported for the deposit (Peredery et al., 1982).

Moak Lake Mine (N.T.S. 63P/13NE; Map C, location no. 56)

The area is located about 1 km north of Moak Lake and 27 km northeast of the city of Thompson.

The deposit was discovered in 1952. Development work was carried out on the property from 1956 to 1958 when work was suspended. Reserves of 45.4 million tonnes grading 0.7% Ni which were reported in the Northern Miner, August 7, 1961, were said to be incorrect by Inco staff (Mineral Inventory card 63P/13 NI 1).

"The linear to irregular deposit is 305 m thick, up to 31 m wide, and over 762 m long (open-ended)" (Mineral Inventory card 63P/13 NI 1). "The nickel sulphide mineralization is associated with a deformed serpentinite body that takes the form of a syncline approximately concordant with the enveloping sediments. The nickel sulphide content is extremely variable and mineralization ranges from disseminated zones to massive sulphide veins (Coats et al., 1972)" (Theyer, 1980). Minerals present include pyrrhotite, pentlandite, magnetite, with minor chalcopyrite and violarite (Phillips, 1979). Rocks adjacent to the deposit include quartzite, impure quartzite, altered limestone, and well-banded granitoid gneiss (Patterson, 1963).

A Pt/Pd ratio of 0.89 (based on weight percent) was reported for the deposit (Peredery et al., 1982). Ore samples of the deposit were selected from GSC collections for PGM analyses, by lead fire-assay, and by carbon-rod atomic absorption spectrometric methods (Jonasson et al., 1987). Results, representing heavy mineral concentrates, are shown in Table 19.

Table 19
Preliminary results of analyses of Cu-Ni ores from the Moak Lake Mine
(from Jonasson et al., 1987)

	Pt ppb	Pd ppb	Au ppb	Pt/(Pt+Pd)	Sample Number
	5	40	30	0.111	305A
	0	35	20	0	305B
	25	245	10	0.093	305C
Mean Values	10	107	20	0.085	
Detection Limits	5	5	5		

South Manasan (N.T.S. 63P/12SW; Map C, location no. 51)

A 250-1000 m wide ultramafic body in the Thompson Nickel Belt, referred to as 'South Manasan', consists of dunite and peridotite: it is reported to have a Ni/Cu ratio of 20 (based on weight percent), a Ni/(Ni + Cu) ratio of 0.95, and a Pt/Pd ratio of 0.45 (Peredery et al., 1982). The location of this occurrence is not known with certainty.

Phanerozoic-Covered Areas

Limited platinum sampling programs were carried out in Phanerozoic-covered localities (Cedar Lake and Hargrave River properties) of the Churchill-Superior boundary zone, south of the Thompson Nickel Belt, using 1970's drill core stored in the Thompson Core Library, Manitoba Mines Branch. The PGE analyses were ordered by Hawk Mountain Resources and done by Bondar Clegg & Company Ltd. using a neutron activation method with detection limits of 10 ppb Pd, 10 ppb Pt, 10 ppb Ru, 5 ppb Os, 1 ppb Rh, 0.5 ppb Au, 0.5 ppb Ir. The Minago River nickel deposit, hosted by serpentinized ultramafic rocks, is reported to contain platinum and palladium.

Cedar Lake property (N.T.S. 63G/5NE; Figure 5, location no. 8)

The property, located 15 km east of Clear Bay in Cedar Lake and 7 km south of Norris Lake, had been drilled by Amax Potash Limited in 1972. In 1986, it was reported that a sample of core from drill hole ddh no. MXD72-1, returned an assay of: 26 ppb Ru, 24 ppb Pt, 16 ppb Pd, 12 ppb Rh, 9.8 ppb Ir, 7 ppb Os, 0.7 ppb Au (Non-confidential Assessment File No. 91829).

Hargrave River property (N.T.S. 63J/6SE; Figure 5, location no. 9)

The property, located approximately 23 km west of Kiskitto Lake, 6 km north of Minago River, and just south of CB 2550 (Mineral Inventory card 63J/6 CR 1), had previously been drilled by Cominco Ltd. and by Minago Mines in 1969-1972. In 1986, drill core from four holes (ddh nos. MXB70-30, -38, -43, CO 71-151) was sampled for analysis: one sample returned 132 ppb Pd, 12 ppb Pt, 10 ppb Ru, 2.2 ppb Ir, 1.5 ppb Au, less than 5 ppb Os, and less than 1 ppb Rh; other samples contained "less than 100 ppb Ir" (Non-confidential Assessment File Nos. 92283, 91522).

Minago River (N.T.S. 63J/3SE; Figure 1)

The nickel deposit is located 10 km south of Minago River, about 14.5 km northeast of William Lake and 2.5 km west of Provincial Road No. 6. The history of exploration in this area is detailed in Mineral Inventory card 63J/3 NI 1.

The deposit was discovered at the end of a 1968-1969 winter drilling program by Amax Exploration, Inc., following airborne geophysical work in 1966. Black Hawk Mining is currently developing the deposit, which is estimated to contain 1 996 370 tonnes of ore grading 1.64% Ni, or 10 526 315 tonnes grading 1.12% Ni (Northern Miner, August 28, 1989).

The deposit is a near-vertical tabular body that strikes 135° (Northern Miner, August 28, 1989). It lies under about 76.2 m of Paleozoic rocks, where it is hosted by ultramafic rocks. Mineralization consists of finely disseminated pentlandite and millerite with minor violarite and heazelwoodite (Mineral Inventory card 63J/3 NI 1). "By-product credits of copper, platinum, palladium, gold and silver with a gross value of $9-$10 per ton are also present" (Northern Miner, August 28, 1989).

Other Explored Areas

Wintering Lake (N.T.S. 63P/5NE; Map C, location nos. 57 and 58)

In 1929, Dion Mining Corporation Limited reported finding platinum in assays of samples collected from the Rat claim and from the Homebrew claim in the Wintering Lake district.

According to the Manitoba Free Press (April 3, 1929): "nickel and platinum assays were made from channel samples taken from the Rat claim, one of the Dion holdings, and situated on a small island at the northwest arm of the lake". Assay figures, apparently indicating "excellent values" in platinum on this property, were not released. However, H.V. Hudson, vice-president of Dion Mining, "permitted the disclosure of values a mile (1.6 km) south of Rat claim.

"On the Homebrew claim, one of the northern groups, pit assays showed values of $16 for copper and $2.80 for silver. A re-assay showed platinum present also" (1929 newspaper clipping in Manitoba Mines Branch, Corporation File, Dion Mining Corporation Limited). The Homebrew M.C. property, located near the north end of Wintering Lake, contains disseminated sulphides in a "possible fault/shear zone which cuts Precambrian gabbro" (Mineral Inventory card 63P/5 CU 1). According to Fraser (1928?), the area is underlain by "basic schists, basic dykes and minor amounts of grey gneiss".

Other minerals found on the "property" of Dion Mining include gold and tin; nickel mineralization was also reported 16 km east of the Rat claim (Manitoba Free Press, May 28, April 3, 1929).

The location of the Rat claim is not known with certainty. The Rat claim on which trenching, stripping and test-pitting was being carried out by Dion Mining Corporation Limited, was apparently located on an island at the north end of Wintering Lake according to 1929 newspaper clippings (Manitoba Mines Branch, Corporation File, Dion Mining Corporation Limited). However, at the time, there were two Rat claims staked in the Wintering Lake area: one, on which a 9-12 m shaft had been sunk in 1928, was adjacent to the Homebrew M.C. claim; the other Rat claim was on an island about 16 km southwest of Homebrew (Mineral Inventory card 63P/5 CU 1).

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